

DAS Data Requirement 16

Demand Access System (DAS) Reliability/Maintainability/Availability (RMA) Analysis Report

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1. INTRODUCTION

1.1 IDENTIFICATION

This document provides the results of reliability, maintainability, and availability (RMA) analyses performed in support of the DAS Program.

1.2 SYSTEM OVERVIEW

The purpose of the DAS is to allow expansion of the Tracking and Data Relay Satellite System (TDRSS) Multiple Access Return (MAR) capabilities at a relatively low cost. The DAS will build on the Third Generation Multiple Access Beamformer Subsystem (TGBFS) development by adding demodulation functions, global system control and coordination functions, and data distribution capabilities. Figure 1-1 provides a functional block diagram of the DAS. Key features include the following:

- The initial DAS configuration will include a) three Independent Beamformer Unit Groups (IBUGs) - two at the White Sands Ground Terminal (WSGT) and one at the Guam Remote Ground Terminal (GRGT) - and b) two Demodulator Groups (DMGs) – one at each ground terminal.
- The final DAS configuration will include up to 10 IBUGs and eight DMGs at each ground terminal.

1.3 DOCUMENT ORGANIZATION

This document is organized as follows:

- Section 1 provides identification, system overview, and document overview.
- Section 2 provides the DAS RMA Prediction Report.
- Section 3 provides the DAS RMA Failure Modes and Effects Analysis (FMEA) Report.

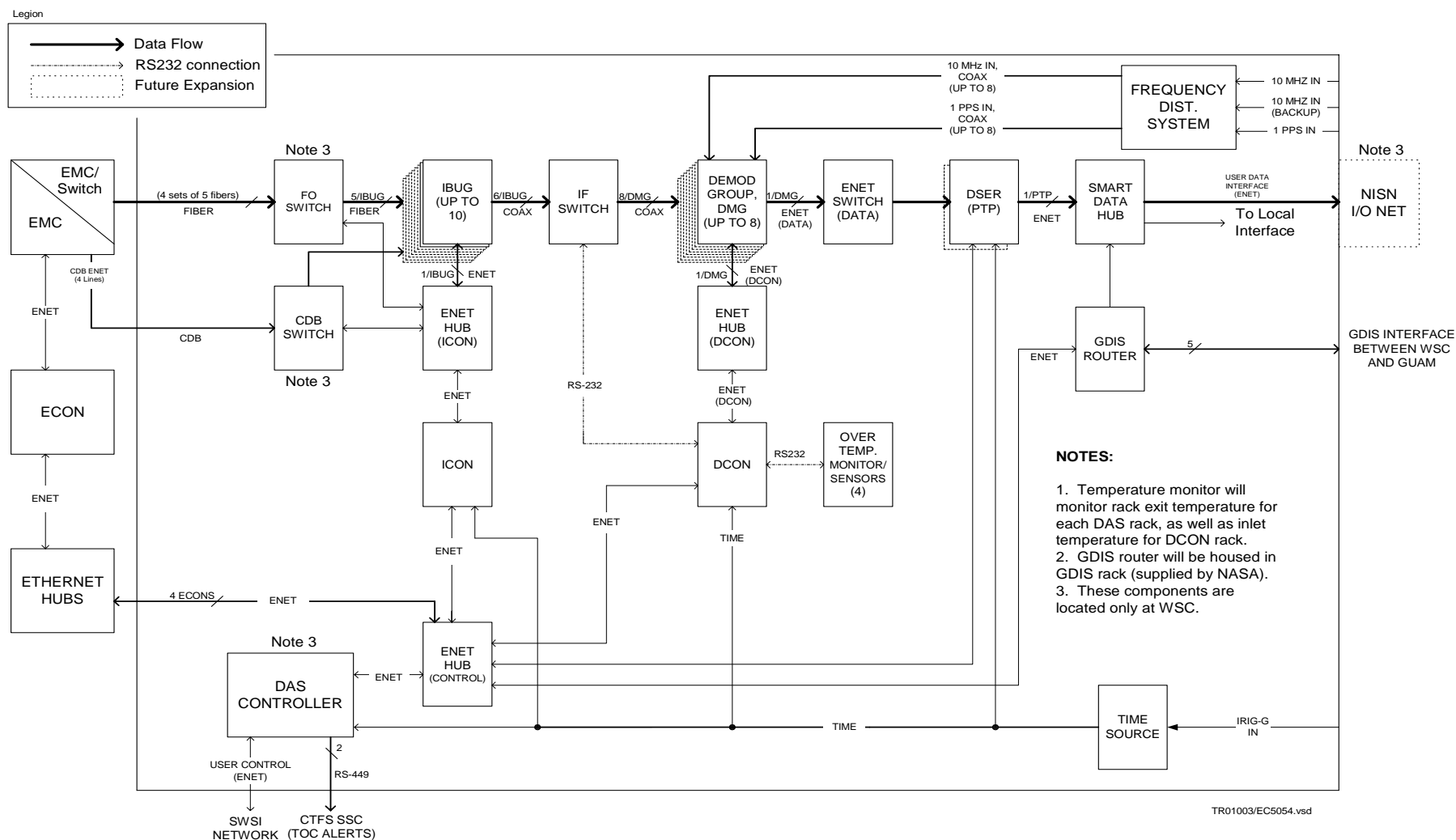


Figure 1-1: DAS Functional Block Diagram

2. DAS RMA PREDICTION REPORT

2.1 INTRODUCTION

2.1.1 Identification

This Reliability/Maintainability/Availability Prediction report contains the revised prediction of the Demand Access System (DAS) equipment. Supporting assumptions, analyses and methodologies are described, as appropriate. This analysis was conducted in accordance with MIL-HDBK-217F.

The primary objective of this prediction report is to estimate the quantitative RMA of the preliminary design and to determine the design concept's capability of achieving the allocated requirements. These predictions are intended to establish an estimate of successful performance of all hardware, both separately and collectively. This is accomplished by establishing failure rate and repair time data for all hardware.

2.1.2 Applicable Documents

2.1.2.1 Program Documents

| <u>Document Identification</u> | <u>Document Title</u> |
|--------------------------------|--|
| 451-DAS-SRD | DAS System Requirements Document |
| DID/DRL No. 16 | DAS Data Item Description/Deliverable Requirements List 16 |

2.1.2.2 Reference Documents

| <u>Document Identification</u> | <u>Document Title</u> |
|--------------------------------|--|
| MIL-HDBK-217 | Reliability Prediction of Electronic Equipment |
| MIL-STD-756 | Reliability Modeling and Prediction |
| MIL-STD-785 | Reliability Program for System and Equipment, Development and Production |
| MIL-HDBK-470 | Designing and Developing Maintainable Products and Systems |
| MIL-HDBK-472 | Maintainability Prediction |

2.2 ASSUMPTIONS

The Ground, Benign (GB) environment of MIL-HDBK-217F at 25°C was used as the primary source for failure rate information. Where possible, actual vendor reliability data was used. In several instances, insufficient or limited reliability information was available for a given unit/device. For these cases,

values were assumed based on similar hardware. Assumptions made to support this prediction are summarized in Table 2-1.

Table 2-1: DAS R/M/A Prediction Assumptions

| CI-LRU | Assumptions |
|----------------------|---|
| General | The hardware/software design and manufacturing process is mature and all workmanship failures have been eliminated. |
| General | All integrated circuits had a quality level of B-1. |
| General | MTBF of fans considered as the failure rate of rotating ball bearings. |
| General | Inherent and Operational Availability calculations did not consider recent design decisions to include the GDIS router and AVTEC PTP Server. |
| General | Operational Availability is defined as the availability to support 50 simultaneous users over a 10,000 hour contiguous interval, except during the loss of facility services such as power or air conditioning, or loss of system capability such as unusual weather conditions, such as icing or severe rain storms. |
| Mechanical and Power | Mechanical is comprised of rack assemblies which include rack, slides, fans, and blowers. CI only consists of a Temperature Monitor. Power strip, cables, and temperature sensor were not considered based on their failure rates. |
| IF Switch | MTBF was supplied by the vendor for entire IF Switch and is a conservative estimate. |

2.3 ANALYSIS METHODOLOGY

2.3.1 Reliability

The reliability prediction was performed to establish the failure rate and provide the Mean Time Between Failures (MTBFs) for each CI. The MTBF values were then used for the Availability calculation. This model assumes that every single point of failure is critical and has an impact on system operation. Failure rates are related to MTBF by the following equation:

$$MTBF_{CI} = \frac{1}{\sum \lambda_i}$$

where

$MTBF_{CI}$ = Total Mean Time Between Failure of the Configuration Item

λ_i = Failure Rate for LRU components within the Configuration Item

Using the failure rate of each item, a series model was employed to determine the failure rate of the next higher assembly until the overall DAS results were calculated. Relex Reliability Software, version 7.1, was used to perform the MTBF calculations.

2.3.2 Mean Time To Repair

The maintainability prediction was performed to provide the LRU/CI MTTR to be used in the Availability calculation. Lower level assembly MTTR values were determined based on the availability of spares, ability to isolate faults, accessibility of failed hardware, and maintenance knowledge. It was assumed that the operators and technicians possessed the necessary information and skills to perform adequate and timely fault isolation and that available spares were on hand.

Once established, the lower level values were used to calculate the next higher assemblies using Method II of MIL-HDBK-217 and the following expression:

$$MTTR_{CI} = \frac{\sum_i^n \frac{MTTR_i}{MTBF_i}}{\sum_i^n \frac{1}{MTBF_i}}$$

where

MTTR_{CI} = Total Mean Time To Repair each Configuration Item
 MTTR_i = MTTR of each LRU within the Configuration Item
 MTBF_i = MTBF of each LRU within the Configuration Item
 n = number of LRUs within the Configuration Item

2.3.3 Availability

2.3.3.1 Inherent Availability

The availability prediction was performed to establish inherent availability (A_i) of the preliminary design. This prediction was accomplished by using the appropriate LRU/CI level results of the Reliability and Maintainability predictions and the following expression:

$$A_i = \frac{MTBF_{DAS}}{MTBF_{DAS} + MTTR_{DAS}}$$

where

MTBF_{DAS} = Total Mean Time Between Failure of the DAS System
 MTTR_{DAS} = Total Mean Time to Repair of the DAS System

An additional diagnostic time was added to each CI MTTR value for the Inherent Availability calculations based on experience with similar equipment. Because DAS is designed to interface with equipment in the WSGT and GRGT, an A_i was calculated for each location.

2.3.3.2 Operational Availability

a. DAS Operational Availability Requirement

The DAS SRD states that for each DAS there shall be a communications path from the output of the EMC to the Data Routing and Archiving external interface, such that the operational availability, measured over a 10,000 hour interval, is 0.9999. Redundant paths may be used to achieve this operational availability (A_o).

b. DAS Operational Availability Calculations

The operational availability of the DAS is defined in terms of each multiple access Customer service. For each DAS there are redundant communication paths from the output of the EMC to the Data Routing and Archiving external interface. The computation of operational availability for DAS uses the following expression:

$$A_o = \frac{\text{Available Service Time}}{\text{Available Service Time} + \text{Unavailable Service Time}}$$

The Available Service Time is measured over a contiguous 10,000 hour interval except that any loss of availability due to loss of facility services such as power or air conditioning, or loss of system capability resulting from unusual weather conditions, such as icing or severe rain storms, is not counted.

The Unavailable Service Time includes all times service is not available due to corrective maintenance downtime, administrative downtime, logistics supply downtime, and preventive maintenance downtime.

MTBF and MTTR values were assigned to each component with DAS configuration items. Failure and repair rates were derived from previous analyses, similar equipment, past experience, and system complexity. MTBF and MTTR values were calculated in accordance with MIL-HDBK-217F for each configuration item using the following equations.

$$MTBF_{CI} = \frac{1}{\sum \lambda_i}$$

where

$MTBF_{CI}$ = Total Mean Time Between Failure of the Configuration Item

λ_i = Failure Rate for components within the Configuration Item

and

$$MTTR_{CI} = \frac{\sum_i^n \frac{MTTR_i}{MTBF_i}}{\sum_i^n \frac{1}{MTBF_i}}$$

where

$MTTR_{CI}$ = Total Mean Time To Repair each Configuration Item
 $MTTR_i$ = MTTR of each component within the Configuration Item
 $MTBF_i$ = MTBF of each component within the Configuration Item
 n = number of components within the Configuration Item

A fault isolation time of 60 minutes was added to the Mechanical and Power Configuration Item to account for operator fault diagnosis and repair activity.

Using the failure rate and repair time of each item, a series model was used to determine the failure rate and repair time of the next higher assembly, until the overall DAS results were calculated (i.e., $MTBF_{DAS}$ and $MTTR_{DAS}$). Finally, an overall operational availability value was calculated using:

$$A_o = \frac{MTBF_{DAS}}{MTBF_{DAS} + MTTR_{DAS}}$$

where

$MTBF_{DAS}$ = Total Mean Time Between Failure of the DAS System
 $MTTR_{DAS}$ = Total Mean Time to Repair of the DAS System

2.3.3.3 Redundancy Calculations

To support 50 simultaneous users, the DAS must use 10 IBUGs and 8 DMGs. Each IBUG contains 6 IBUs and each DMG includes eight DMUs. Figures 2-1 and 2-2 provide Reliability Block Diagrams for the IBUGs and DMGs.

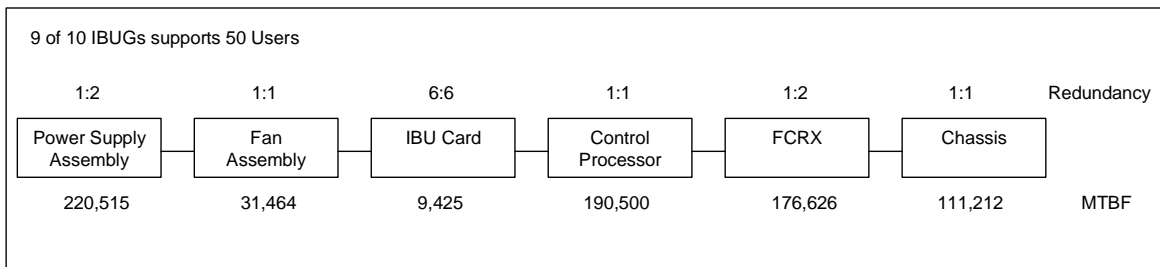


Figure 2-1: IBUG Reliability Block Diagram

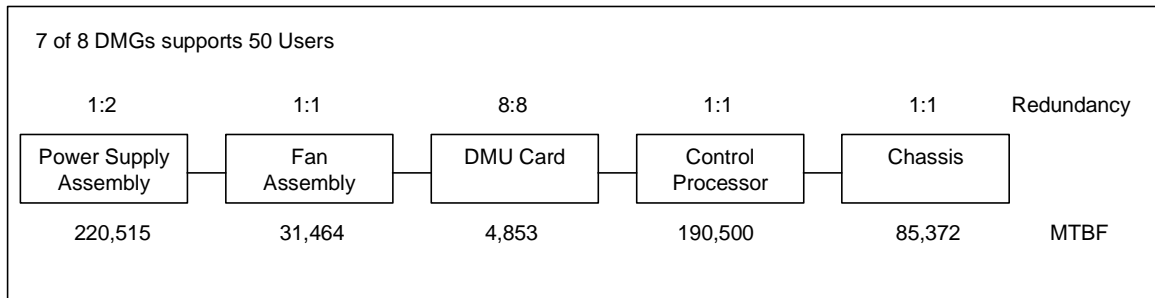


Figure 2-2: DMG Reliability Block Diagram

For m out of n redundancy of the DMU and IBU, the following expression was used to calculate the Reliability:

$$R_{\text{Redundancy}} = 1 - \sum_{i=0}^{m-1} \left[\frac{n!}{i!(n-i)!} \right] R^i (1-R)^{n-i}$$

where the Reliability of the individual component is derived from

$$R_{\text{component}} = e^{\frac{-t}{MTBF}}$$

where $t = 10,000$ hours

2.4 RESULTS

2.4.1 Reliability Results

Table 2-2 summarizes the results of the reliability prediction analysis. The predicted CI MTBF values exceeded all allocated values from the DAS RMA Allocation, as shown. Appendix A provides the inherent availability results from which the predicted configuration item values were derived, and Appendix B provides the detailed operational availability calculations.

Table 2-2: Configuration Item MTBF Prediction vs Allocation

| Configuration Item (CI) | Predicted MTBF (hr) | Allocated MTBF (hr) |
|----------------------------------|---------------------|---------------------|
| Beamformer (IBUG) CI | 11,890 | 9,500 |
| Demodulator (DEMOD) CI | 11,966 | 7,500 |
| EMC Interface CI | 9,503 | 8,500 |
| Frequency and Timing CI | 42,480 | 42,000 |
| IF Switch CI | 125,000 | 125,000 |
| IBUG Controller (ICON) CI | 15,205 | 11,000 |
| Demodulator Controller (DCON) CI | 15,205 | 11,000 |
| DAS Controller (DASCON) CI | 13,934 | 8,000 |
| Data Formatter/Archive Server CI | 13,934 | 11,000 |
| Mechanical and Power CI | 435,000 | 400,000 |

2.4.2 Maintainability Results

The MTTR values were refined from the previous prediction based on experience with similar equipment components and inspection of some engineering development models. The calculated MTTR for the DAS at WSGT was 5 minutes, while for the DAS at GRGT it was 3 minutes. These calculations considered the expected 10-year lifetime of the DAS, operational redundancy, and fault isolation times. The Maintainability prediction will be reviewed based on the individual LRU MTTRs determined during O&M development and updated in a revised DAS Final Prediction Report only if the results are significantly affected.

2.4.3 Availability Results

Table 2-3 shows the results of the inherent and operational availability calculations for the DAS at the WSGT and GRGT locations. Based on these calculations, and assuming the equipment listed in Appendix A does not change appreciably, the DAS meets and exceeds the stated 0.995 requirement for inherent availability.

Table 2-3: DAS Availability Prediction

| Availability | Requirement | WSGT | GRGT |
|--------------|-------------|--------|--------|
| Inherent | 0.995 | 0.9996 | 0.9997 |
| Operational | 0.9999 | 0.9998 | 0.9999 |

Operational availability results for the DAS as the WSGT and GRGT were calculated using redundant IBUGs, DMGs, and other components such as fans and power supplies required to support a maximum of 50 Customers. If a component was hot-swappable and redundant, the resultant MTTR was considered to be zero.

Based on these calculations, and assuming the equipment does not change appreciably, the DAS meets the 0.9999 operational availability requirement in the GRGT configuration. Because the design complexity is greater at WSGT, the operational availability is slightly less (by 0.01 percent) than the 0.9999 requirement. To improve these results, any one of the following design alternatives should be incorporated:

1. Add redundant fans in the EMC Interface and DASCON, or
2. Add a redundant DASCON, or
3. Add a redundant Data Formatter/Archive Server, or
4. Add a redundant EMC Interface

APPENDIX 2-A

DAS INHERENT AVAILABILITY CALCULATIONS

| <i>DAS Inherent Availability</i> | | | | | | |
|---|------------|------------------------------|----------------------|-----------------------|---------------------------------------|-----------------------------|
| CI | LRU | Component | MTBF (hr) | MTTR (min) | Fault Isolation Time (min) | Total MTTR (min) |
| Beamformer (IBUG) CI | | | 11,890 | 17 | 15 | 32 |
| | | Control Processor | 190,500 | 10 | | |
| | | IBU Card | 56,547 | 10 | | |
| | | Fiber Channel Receiver Card | 88,313 | 10 | | |
| | | Chassis | 111,212 | 60 | | |
| | | Power Supply | 110,257 | 10 | | |
| | | Fan | 31,464 | 15 | | |
| Demodulator Group (DMG) CI | | | 11,966 | 20 | 15 | 35 |
| | | CP | 190,500 | 10 | | |
| | | DMU Card | 38,825 | 15 | | |
| | | Chassis | 85,372 | 60 | | |
| | | Power Supply | 110,257 | 10 | | |
| | | Fan | 31,464 | 15 | | |
| EMC Interface CI | | | 9,503 | 12 | 15 | 27 |
| | | CDB Switch | 304,182 | 10 | | |
| | | Power Supply Assembly | 100,000 | 10 | | |
| | | Fan Assembly | 31,464 | 10 | | |
| | | Serial Port Card | 166,667 | 10 | | |
| | | Control Processor | 190,500 | 10 | | |
| | | Fiber Optic Switch | 20,447 | 15 | | |
| | | NTS Box | 88,476 | 30 | | |
| | | NTS Fan | 144,540 | 10 | | |
| | | FO Port Card (quantity=5) | 32,587 | 10 | | |
| Frequency and Timing CI | | | 42,480 | 15 | 15 | 30 |
| | | Switch and Distribution Unit | 282,461 | 15 | | |
| | | Pulse Distribution Assembly | 50,000 | 15 | | |
| IF Switch CI | | | 125,000 | 10 | 30 | 40 |
| | | IF Switch | 125,000 | 10 | | |
| IBUG Controller (ICON) CI | | | 15,205 | 28 | 15 | 43 |
| | | 450 MHz Server Assembly | | | | |
| | | Computer | 17,646 | 30 | | |
| | | CP & Motherboard | 100,000 | | | |
| | | CD ROM | 100,000 | | | |
| | | 10/100 PCI NIC | 166,667 | | | |
| | | IRIG-B Time Card | 315,457 | | | |
| | | Hard Disk Drive | 400,000 | | | |
| | | Fan | 40,000 | | | |
| | | Power Supply | 200,000 | 10 | | |
| | | Ethernet Hub (FastHub 412) | 244,007 | 15 | | |

| <i>DAS Inherent Availability</i> | | | | | | |
|---|----------------------------|------------------|----------------------|-----------------------|---------------------------------------|-----------------------------|
| CI | LRU | Component | MTBF (hr) | MTTR (min) | Fault Isolation Time (min) | Total MTTR (min) |
| Demodulator Controller (DCON) CI | | | 15,205 | 28 | 15 | 43 |
| | 450 MHz Server Assembly | | | | | |
| | Computer | | 17,646 | 30 | | |
| | | CP & Motherboard | 100,000 | | | |
| | | CD ROM | 100,000 | | | |
| | | 10/100 PCI NIC | 166,667 | | | |
| | | IRIG-B Time Card | 315,457 | | | |
| | | Hard Disk Drive | 400,000 | | | |
| | | Fan | 40,000 | | | |
| | Power Supply | | 200,000 | 10 | | |
| | Ethernet Hub (FastHub 412) | | 244,007 | 15 | | |
| DAS Controller (DASCON) CI | | | 13,934 | 27 | 15 | 42 |
| | 600 MHz Server Assembly | | | | | |
| | Computer | | 16,620 | 30 | | |
| | | CP & Motherboard | 100,000 | | | |
| | | CD ROM | 100,000 | | | |
| | | 10/100 PCI NIC | 83,334 | | | |
| | | (quantity=2) | | | | |
| | | IRIG-B Time Card | 315,457 | | | |
| | | Fan | 40,000 | | | |
| | RAID 1 Drive | | 400,000 | 5 | | |
| | Power Supply | | 200,000 | 10 | | |
| | Ethernet Hub | FastHub 412 | 244,007 | 15 | | |
| Data Formatter/Archive Server CI | | | 13,934 | 27 | 15 | 42 |
| | 600 MHz Server Assembly | | | | | |
| | Computer | | 16,620 | 30 | | |
| | | CP & Motherboard | 100,000 | | | |
| | | CD ROM | 100,000 | | | |
| | | 10/100 PCI NIC | 83,334 | | | |
| | | (quantity=2) | | | | |
| | | IRIG-B Time Card | 315,457 | | | |
| | | Fan | 40,000 | | | |
| | RAID 1 Drive | | 400,000 | 5 | | |
| | Power Supply | | 200,000 | 10 | | |
| | Ethernet Hub | FastHub 412 | 244,007 | 15 | | |
| Mechanical and Power CI | | | 435,000 | 10 | 60 | 70 |
| | Temperature Monitor | | 435,000 | 10 | | |
| Notes: 1) MTBF and MTTR values for each LRU and component are derived from previous analyses, similar equipment, past experience, and complexity of the system. 2) MTTR values based on spare components and tools present on site, and immediately accessible. 3) Mechanical and Power CI includes a power strip, cables, and a temperature sensor. Because the failure rates for these components are extremely low, they are not included in this analysis. | | | | | | |

APPENDIX 2-B

DAS OPERATIONAL AVAILABILITY CALCULATIONS

| CI | LRU | Component | Red. x of y | MTBF (hours) | | | MTTR (minutes) | | | Hot Swap. and Red. |
|----------------------------|-----|------------------------------|----------------|--------------|----------|-------------|----------------|--------------------|-------------|-----------------------|
| | | | | Base | Total CI | Oper. CI | Base | Fault Isolation | Operational | |
| Beamformer (IBUG) CI | | | 9 10 | 6,160 | | 800 | 0 | 0 | 0 | Red |
| | | Control Processor | 1 1 | 190,500 | 190,500 | | | | | no |
| | | IBU Card | 6 6 | 56,547 | 9,425 | | | | | Both |
| | | Fiber Channel Receiver Card | 1 2 | 88,313 | 176,626 | | | | | Red |
| | | Chassis | 1 1 | 111,212 | 111,212 | | | | | no |
| | | Power Supply | 1 2 | 110,257 | 220,514 | | | | | Both |
| | | Fan | 1 1 | 31,464 | 31,464 | | | | | no |
| Demodulator Group (DMG) CI | | | 7 8 | 3,856 | | 620 | 0 | 0 | 0 | Red |
| | | CP | 1 1 | 190,500 | 190,500 | | | | | no |
| | | DMU Card | 8 8 | 38,825 | 4,853 | | | | | Both |
| | | Chassis | 1 1 | 85,372 | 85,372 | | | | | no |
| | | Power Supply | 1 2 | 110,257 | 220,514 | | | | | Both |
| | | Fan | 1 1 | 31,464 | 31,464 | | | | | no |
| EMC Interface CI | | | 1 1 | 5,162 | | 5,162 | 12 | 0 | 12 | no |
| | | CDB Switch | 1 1 | 304,182 | 304,182 | | 10 | | | no |
| | | Power Supply Assembly | 1 2 | 110,257 | 220,514 | | 0 | | | Both |
| | | Fan Assembly | 1 1 | 25,000 | 25,000 | | 10 | | | HS |
| | | Serial Port Card | 1 1 | 166,667 | 166,667 | | 10 | | | no |
| | | Control Processor | 1 1 | 190,500 | 190,500 | | 10 | | | no |
| | | Fiber Optic Switch | 2 2 | 14,854 | 7,427 | | 13 | | | no |
| | | NTS Box | 1 1 | 88,476 | | | 30 | | | |
| | | NTS Fan | 1 1 | 144,540 | | | 10 | | | |
| | | FO Port Card | 8 8 | 162,936 | | | 10 | | | |
| Frequency and Timing CI | | | 1 1 | 42,480 | | 42,480 | 15 | 0 | 15 | no |
| | | Switch and Distribution Unit | 1 1 | 282,461 | | | 15 | | | no |
| | | Pulse Distribution Assembly | 1 1 | 50,000 | | | 15 | | | no |
| IF Switch CI | | | 1 1 | 125,000 | | 125,000 | 10 | 0 | 10 | no |
| | | IF Switch | 1 1 | 125,000 | 125,000 | | 10 | | | no |

| CI | LRU | Component | Red. x of y | MTBF (hours) | | | MTTR (minutes) | | | Hot Swap. and Red. |
|----------------------------------|-----------------------------|------------------|----------------|--------------|----------|-------------|----------------|--------------------|-------------|-----------------------|
| | | | | Base | Total CI | Oper. CI | Base | Fault Isolation | Operational | |
| IBUG Controller (ICON) CI | | | 1 1 | | 15,806 | 15,806 | 28 | 0 | 28 | no |
| | 450 MHz Server Assembly | | 1 1 | | | | | | | |
| | Computer | | 1 1 | 17,646 | 17,646 | | 30 | | | no |
| | | CP & Motherboard | 1 1 | 100,000 | | | | | | |
| | | CD ROM | 1 1 | 100,000 | | | | | | |
| | | 10/100 PCI NIC | 1 1 | 166,667 | | | | | | |
| | | IRIG-B Time Card | 1 1 | 315,457 | | | | | | |
| | | Hard Disk Drive | 1 1 | 400,000 | | | | | | |
| | | Fan | 1 1 | 40,000 | | | | | | |
| | Power Supply | | 1 2 | 200,000 | 400,000 | | 0 | | | Both |
| | Ethernet Hub (FastHub 412) | | 1 1 | 244,007 | 244,007 | | 15 | | | no |
| Demodulator Controller (DCON) CI | | | 1 1 | | 15,806 | 15,806 | 28 | 0 | 28 | no |
| | 450 MHz Server Assembly | | 1 1 | | | | | | | |
| | Computer | | 1 1 | 17,646 | 17,646 | | 30 | | | no |
| | | CP & Motherboard | 1 1 | 100,000 | | | | | | |
| | | CD ROM | 1 1 | 100,000 | | | | | | |
| | | 10/100 PCI NIC | 1 1 | 166,667 | | | | | | |
| | | IRIG-B Time Card | 1 1 | 315,457 | | | | | | |
| | | Hard Disk Drive | 1 1 | 400,000 | | | | | | |
| | | Fan | 1 1 | 40,000 | | | | | | |
| | Power Supply | | 1 2 | 200,000 | 400,000 | | 0 | | | Both |
| | Ethernet Hub (FastHub 412) | | 1 1 | 244,007 | 244,007 | | 15 | | | no |
| DAS Controller (DASCON) CI | | | 1 1 | | 14,702 | 14,702 | 28 | 0 | 28 | no |
| | 600 MHz Server Assembly | | 1 1 | | | | | | | |
| | Computer | | 1 1 | 16,620 | 16,620 | | 30 | | | no |
| | | CP & Motherboard | 1 1 | 100,000 | | | | | | |
| | | CD ROM | 1 1 | 100,000 | | | | | | |
| | | 10/100 PCI NIC | 2 2 | 166,667 | | | | | | |
| | | IRIG-B Time Card | 1 1 | 315,457 | | | | | | |
| | | Fan | 1 1 | 40,000 | | | | | | |
| | RAID 1 Drive | | 1 2 | 400,000 | 800,000 | | 5 | | | Both |
| | Power Supply | | 1 2 | 200,000 | 400,000 | | 0 | | | Both |
| | Ethernet Hub (FastHub 412) | | 1 1 | 244,007 | 244,007 | | 15 | | | no |

| CI | LRU | Component | Red. x of y | MTBF (hours) | | | MTTR (minutes) | | | Hot Swap. and Red. |
|--|--------------------------|------------------|----------------|--------------|----------|-------------|----------------|--------------------|-------------|-----------------------|
| | | | | Base | Total CI | Oper. CI | Base | Fault Isolation | Operational | |
| Data Formatter/Archive Server CI | | | 1 1 | | 14,879 | 14,879 | 28 | 0 | 28 | no |
| | 600 MHz Server Assembly | | 1 1 | | | | | | | |
| | Computer | | 1 1 | 16,620 | 16,620 | | 30 | | | no |
| | | CP & Motherboard | 1 1 | 100,000 | | | | | | |
| | | CD ROM | 1 1 | 100,000 | | | | | | |
| | | 10/100 PCI NIC | 2 2 | 166,667 | | | | | | |
| | | IRIG-B Time Card | 1 1 | 315,457 | | | | | | |
| | | Fan | 1 1 | 40,000 | | | | | | |
| | RAID 1 Drive | | 1 2 | 400,000 | 800,000 | | 5 | | | Both |
| | Power Supply | | 1 2 | 200,000 | 400,000 | | 0 | | | Both |
| | Ethernet Switch (24port) | | 1 1 | 304,182 | 304,182 | | 15 | | | no |
| Mechanical and Power CI | | | 1 1 | | 435,000 | 435,000 | 10 | 60 | 70 | no |
| | Temperature Monitor | | 1 1 | 435,000 | 435,000 | | 10 | | | |
| Notes: | | | | | | | | | | |
| 1) Fault Isolation only applicable to M&P CI | | | | | | | | | | |
| 2) All other assumptions included in RMA Prediction Report | | | | | | | | | | |

3. DAS RMA FMEA REPORT

3.1 INTRODUCTION

3.1.1 Identification

This RMA report provides the Failure Modes Effects Analysis (FMEA) results for the Demand Access System (DAS). Supporting assumptions, analyses, and methodologies are described, as appropriate. The primary objective of this report is to identify critical failures, their effects, and their detectability. This analysis is performed to ensure a reliable design and to guide the generation of diagnostic software and operations and maintenance procedures that will mitigate the identified failure modes.

This analysis was conducted using MIL-STD-1629A as guidance, and is submitted to fulfill the requirements of Deliverable Requirements List (DRL) 16 of the DAS Task Order.

3.1.2 Applicable Documents

3.1.2.1 Program Documents

| | |
|-------------|---|
| 451-DAS-SRD | DAS System Requirements Document |
| DID/DRL16 | DAS Data Item Description/Deliverable Requirements List 16 |

3.1.2.2 Reference Documents

| | |
|--------------|---|
| MIL-HDBK-217 | Reliability Prediction of Electronic Equipment |
| MIL-HDBK-470 | Designing and Developing Maintainable Products and Systems |
| MIL-HDBK-472 | Maintainability Prediction |
| MIL-STD-756 | Reliability Modeling and Prediction |
| MIL-STD-785 | Reliability Program for System and Equipment, Development and Production |
| MIL-STD-1629 | Military Standard Procedures for performing a Failure Mode, Effects and Criticality Analysis |

3.2 TECHNICAL DESCRIPTION

3.2.1 Failure Modes Effects Analysis Methodology

The FMEA was performed using the functional approach, requirements, and methods of MIL-STD-1629, Task 101. This approach recognizes that every Configuration Item (CI) and/or Line Replaceable Unit (LRU) is designed to perform specific functions that can be classified as outputs.

The outputs were listed on FMEA worksheets and their failure modes analyzed. Each identified failure mode was assigned a severity classification, as identified in Table 3-1, which will be used during design to establish priorities for corrective action. Each failure mode was considered to be the only failure in the system. A listing of all Category I and Category II failure modes, independent of cause, was compiled to identify those areas requiring design changes and/or special control measures to mitigate reliability risk.

Table 3-1. Severity Classifications

| Category | Description | Mishap Definition |
|----------|--------------|--|
| I | Catastrophic | Loss of DAS and adverse impact to external/interfacing system components |
| II | Critical | Loss of DAS or Message |
| III | Marginal | Degradation of DAS |
| IV | Negligible | Unscheduled Maintenance or Repair, Inconvenience only |

3.3 FAILURE MODES EFFECTS ANALYSIS RESULTS

The results of the FMEA indicated a total of 61 potential failure modes with the distribution as shown in Table 3-2. The detailed FMEA worksheets for each CI are contained in Appendices 3-A through 3-K.

Of the 61 potential failure modes, none were identified as Category I, and 16 were identified as being Category II or “mission critical”. Recommendations for reducing the risk of these failures are provided in the individual CI FMEA worksheets.

3.4 FAILURE MODES EFFECTS ANALYSIS CONCLUSION

To ensure the reliability of the hardware and mitigate risk, every effort should be made to resolve the Category II findings, as a minimum, by incorporating the recommended changes or some equivalent resolution. Each of the Category II findings will remain open and tracked until evidence can be provided indicating that the reliability risk has been mitigated.

Table 3-2. Total Failure Mode Distribution

| CI/Component | Failure Mode Distribution | | | |
|--------------------------------------|---------------------------|-----------|-----------|----------|
| | Cat I | Cat II | Cat III | Cat IV |
| DAS System | 0 | 16 | 38 | 7 |
| EMC Interface | 0 | 0 | 0 | 0 |
| Control Processor | 0 | 0 | 0 | 0 |
| Fiber Optic Switch | 0 | 0 | 0 | 0 |
| CDB Switch | 0 | 0 | 0 | 0 |
| Fan Assembly | 0 | 0 | 0 | 0 |
| Power Supply Assembly | 0 | 0 | 0 | 0 |
| IBUG | 0 | 0 | 0 | 0 |
| Control Processor | 0 | 0 | 0 | 0 |
| Fiber Channel Receiver Card | 0 | 0 | 0 | 0 |
| Chassis | 0 | 0 | 0 | 0 |
| IBU Card | 0 | 0 | 0 | 0 |
| Fan Assembly | 0 | 0 | 0 | 0 |
| Power Supply Assembly | 0 | 0 | 0 | 0 |
| IF Switch | 0 | 3 | 1 | 0 |
| DEMOD | 0 | 0 | 0 | 0 |
| DMU | 0 | 0 | 0 | 0 |
| Chassis | 0 | 0 | 0 | 0 |
| Control Card | 0 | 0 | 0 | 0 |
| Fan Assembly | 0 | 0 | 0 | 0 |
| Power Supply Assembly | 0 | 0 | 0 | 0 |
| Frequency and Timing | 0 | 1 | 2 | 0 |
| Frequency Distribution System | 0 | 1 | 2 | 0 |
| Time Source | 0 | 0 | 0 | 0 |
| ICON | 0 | 1 | 5 | 0 |
| Server | 0 | 0 | 3 | 0 |
| Ethernet Hub | 0 | 1 | 2 | 0 |
| DCON | 0 | 4 | 7 | 0 |
| Server | 0 | 2 | 4 | 0 |
| Ethernet Hub | 0 | 2 | 3 | 0 |
| DASCON | 0 | 5 | 18 | 0 |
| Controller | 0 | 4 | 9 | 0 |
| Ethernet Hub | 0 | 1 | 9 | 0 |
| Data Formatter/Archive Server | 0 | 2 | 3 | 0 |
| Server | 0 | 2 | 3 | 0 |
| Ethernet Switch | 0 | 0 | 0 | 0 |
| Mechanical and Power | 0 | 0 | 2 | 7 |
| Over Temperature Sensor | 0 | 0 | 2 | 7 |

Appendix 3-A:
EMC Interface Configuration Item
FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/ Resolution |
|---------------|---------------------------|--|--|---|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-1 Closed | Control Processor | Loss of control signal due to connector failure | Inability to control EMC interface - possible inability to process signals | Possible degradation of EMC Interface | Possible loss of all signal processors | III | III | Monitoring and Status (M/S) provided; loss of signal will be detected. |
| 1-2 Closed | Control Processor | Low control signal due to connector failure | Inability or inadvertent control of EMC interface - possible inability to process EMC interface signals | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | NA | Digital Signal; not possible. |
| 1-3 Closed | Control Processor | Noisy control signal due to connector failure | Inability or inadvertent control of EMC interface - possible inability to process EMC interface signals | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | NA | Digital Signal; not possible. |
| 1-4 Closed | Control Processor | Inadvertent control signal due to connector failure | Redefines EMC Interface operation | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | II | M/S provided; loss of signal will be detected. |
| 1-5 Closed | Control Processor | Loss of status signal due to connector failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | M/S provided; loss will be detected and reported. |
| 1-6 Closed | Control Processor | Low status signal due to connector failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Digital Signal; not possible. |
| 1-7 Closed | Control Processor | Noisy status signal due to connector failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Digital Signal; not possible. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/ Resolution |
|----------------|---------------------------|--|---|---|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-8 Closed | Control Processor | Inadvertent status signal due to connector failure | Incorrect status of EMC Interface | False condition of EMC Interface | Possible loss of all signal processors | III | III | Alert provided; loss of signal will be detected (same as 1-4). |
| 1-9 Closed | Control Processor | Loss of control signal due to software error | Possible inability to control EMC interface signals | Possible degradation of EMC Interface | Possible loss of all signal processors | III | III | M/S provided; loss of signal will be detected. |
| 1-10 Closed | Control Processor | Inadvertent control signal due to software error | Redefines EMC Interface operation | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | II | M/S provided; loss of signal will be detected. |
| 1-11 Closed | Control Processor | Loss of status signal due to software error | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | M/S provided; loss of signal will be detected. |
| 1-12 Closed | Control Processor | Inadvertent status signal due to software error | Incorrect status of EMC Interface | False condition of EMC Interface | Possible loss of two signal processors | III | III | M/S provided; loss of signal will be detected. |
| 1-13 Closed | Control Processor | Loss of control processor due to hardware failure | Possible inability to control EMC interface signals | Possible degradation of EMC Interface | Inability to switch signal processors | III | III | M/S provided; loss of signal will be detected. |
| 2-1 Closed | Fiber Optic Switch | Loss of inputs due to EMC failure | Signals not received by system | Loss of all inputs | Loss of all signal processors – mission failure | II | II | M/S provided; loss of signal will be detected. |
| 2-2 Closed | Fiber Optic Switch | Loss of single input due to EMC failure | Loss of single input to Fiber Optic Switch | Loss of single input to EMC Interface | Possible degradation of system. | III | III | Monitoring provided; loss of signal will be detected. |
| 2-3 Closed | Fiber Optic Switch | Low individual input signal due to EMC failure | Low input signal to single Fiber Optic Switch | Low single input to EMC Interface | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-4 Closed | Fiber Optic Switch | Low input signals due to EMC failure | Low input signals received by Fiber Optic Switch | Loss of all inputs to EMC Interface | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-5 Closed | Fiber Optic Switch | Noisy individual input signal due to EMC failure | Noisy input signal to single Fiber Optic Switch | Noisy single input to EMC Interface | Possible degradation of system. | III | NA | Digital Signal; not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/ Resolution |
|----------------|---------------------------|--|--|---------------------------------------|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-6 Closed | Fiber Optic Switch | Noisy input signals due to EMC failure | Noisy input signals received by Fiber Optic Switch | Noisy single input to EMC Interface | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-7 Closed | Fiber Optic Switch | Incorrect signal format due to EMC failure | Inability to establish proper data signals | Unrecognized EMC input signals | Loss of all signal processors – mission failure | II | II | Monitoring/Status (M/S) provided; loss of signal will be detected. |
| 2-8 Closed | Fiber Optic Switch | Loss of all inputs due to connector failure | Signals not received by system | Loss of all inputs | Loss of all signal processors – mission failure | II | NA | Not possible; signals on separate connectors. |
| 2-9 Closed | Fiber Optic Switch | Loss of individual input due to connector failure | Loss of single input to Fiber Optic Switch | Loss of single input to EMC Interface | Possible degradation of system. | III | III | Monitoring provided; loss of signal will be detected. |
| 2-10 Closed | Fiber Optic Switch | Low individual input signal due to connector failure | Low input signal to single Fiber Optic Switch | Low single input to EMC Interface | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-11 Closed | Fiber Optic Switch | Low input signals due to connector failure | Low input signals received by Fiber Optic Switch | Loss of all inputs to EMC Interface | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-12 Closed | Fiber Optic Switch | Noisy individual input signal due to connector failure | Noisy input signal to single Fiber Optic Switch | Noisy single input to EMC Interface | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-13 Closed | Fiber Optic Switch | Noisy input signals due to connector failure | Noisy input signals received by Fiber Optic Switch | Noisy single input to EMC Interface | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-14 Closed | Fiber Optic Switch | Loss of output due to hardware failure | Loss of single output to IBUG | No effect | Loss of all signal processors – mission failure | III | III | Monitoring provided; loss of signal will be detected. |
| 2-15 Closed | Fiber Optic Switch | Noisy output due to hardware failure | Noisy single output to IBUG | No effect | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-16 Closed | Fiber Optic Switch | Low output due to hardware failure | Low single output to IBUG | No effect | Possible degradation of system. | III | NA | Digital Signal; not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/ Resolution |
|----------------|---------------------------------------|---|----------------------------------|--------------------------------|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-17 Closed | Fiber Optic Switch | Loss of output due to connector failure | Loss of single output to IBUG | No effect | Possible degradation of system. | III | III | Monitoring provided; loss of signal will be detected. |
| 2-18 Closed | Fiber Optic Switch | Noisy output due to connector failure | Noisy single output to IBUG | No effect | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-19 Closed | Fiber Optic Switch | Low output due to connector failure | Low single output to IBUG | No effect | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 2-20 Closed | Fiber Optic Switch | Complete FO Switch failure due to bad component | Loss of all outputs to IBUG | No effect | Loss of all signal processors – mission failure | II | II | Monitoring provided; loss of signal will be detected. |
| 3-1 Closed | Common Data Broadcast Switch | Loss of input due to EMC failure. | Signal not received by system | Loss of input to CDB Switch | Reduced C/No | II | IV | Monitoring provided; loss of signal will be detected. Misabeled original severity. |
| 3-2 Closed | Common Data Broadcast Switch | Low input signal due to EMC failure | Low input signal to system | Low input to CDB Switch | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 3-3 Closed | Common Data Broadcast Switch | Noisy input signal due to EMC failure | Noisy input signal to system | Noisy input to CDB Switch | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 3-4 Closed | Common Data Broadcast Switch | Loss of input due to connector failure | Signal not received by system | Loss of input to CDB Switch | Reduced C/No | III | IV | Monitoring provided; loss of signal will be detected. Same as 3-1. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/ Resolution |
|----------------|---------------------------------------|---|---------------------------------|------------------------------|------------------------------------|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 3-5 Closed | Common Data Broadcast Switch | Low input signal due to connector failure | Low input signal to system | Low input to CDB Switch | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 3-6 Closed | Common Data Broadcast Switch | Noisy input signal due to connector failure | Noisy input signal to system | Noisy input to CDB Switch | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 3-7 Closed | Common Data Broadcast Switch | Loss of output due to hardware failure | Loss of output to IBUG | No Effect | Reduced C/No | II | IV | Monitoring provided; loss of signal will be detected. Same as 3-1. |
| 3-8 Closed | Common Data Broadcast Switch | Noisy output due to hardware failure | Noisy output to IBUG | No Effect | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 3-9 Closed | Common Data Broadcast Switch | Low output due to hardware failure | Low output to IBUG | No Effect | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 3-10 Closed | Common Data Broadcast Switch | Loss of output due to connector failure | Loss of output to IBUG | No Effect | Reduced C/No | III | IV | Monitoring provided; loss of signal will be detected. Same as 3-1. |
| 3-11 Closed | Common Data Broadcast Switch | Noisy output due to connector failure | Noisy output to IBUG | No Effect | Possible degradation of system. | III | NA | Digital Signal; not possible. |
| 3-12 Closed | Common Data Broadcast Switch | Low output due to connector failure | Low output to IBUG | No Effect | Possible degradation of system. | III | NA | Digital Signal; not possible. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/ Resolution |
|----------------|---------------------------------------|--|--|--|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 3-13 Closed | Common Data Broadcast Switch | Complete CDB Switch failure due to bad component | Loss of output to IBUG | No Effect | Reduced C/No | II | IV | Monitoring provided; loss of signal will be detected. Same as 3-1. |
| 3-14 Closed | Common Data Broadcast Switch | Loss of CDB Switch due to overtemp. | Loss of output to IBUG | Loss of downconversion of input signal – complete beamformer failure | Reduced C/No | II | IV | Monitoring provided; loss of signal will be detected. Same as 3-1. |
| 4-1 Closed | Fan Assembly | Loss of power due to connector failure | Fan shuts down | Possible loss of entire EMC Interface CI | Possible loss of all signal processors | III | III | Fan's operation is monitored via outlet temperature sensor. |
| 4-2 Closed | Fan Assembly | Low power due to connector failure | Motor burns up - fan shuts down | Possible loss of entire EMC Interface CI | Possible loss of all signal processors | III | III | Fan's operation is monitored via outlet temperature sensor. |
| 4-3 Closed | Fan Assembly | Noisy power due to connector failure | Possible motor problems resulting in the fan shutting down | Possible loss of entire EMC Interface CI | Possible loss of all signal processors | III | NA | AC power; fault not possible. |
| 4-4 Closed | Fan Assembly | Hardware failure | Fan shuts down | Possible loss of entire EMC Interface CI | Possible loss of all signal processors | III | III | Fan's operation is monitored via outlet temperature sensor. |
| 5-1 Closed | Power Supply Assembly | Loss of supply power | Power cannot be supplied to the EMC Interface CI | Loss of entire EMC Interface CI | Loss of all signal processors | II | IV | N+1 power supplies provided and monitored via ICON. |
| 5-2 Closed | Power Supply Assembly | Low supply power | Possible power supplies shut down | Possible loss of entire EMC Interface CI | Possible loss of signals to IBUG | III | IV | N+1 power supplies provided and monitored via ICON. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/ Resolution |
|---------------|-----------------------------|---|--|--|---|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 5-3 Closed | Power Supply Assembly | Noisy supply power | Possible power supplies shut down | Possible loss of entire EMC Interface CI | Possible loss of signals to IBUG | III | IV | N+1 power supplies provided and monitored via ICON. |
| 5-4 Closed | Power Supply Assembly | Loss of DC power due to connector failure | Power cannot be supplied to the EMC Interface CI | Loss of entire EMC Interface CI | Loss of all signal processors – mission failure | II | IV | N+1 power supplies provided and monitored via ICON. |
| 5-5 Closed | Power Supply Assembly | Low DC power due to connector failure | Damage to components on circuit cards – loss of cards | Loss of entire EMC Interface CI | Loss of all signal processors – mission failure | II | IV | N+1 power supplies provided and monitored via ICON. |
| 5-6 Closed | Power Supply Assembly | Noisy DC power due to connector failure | Damage to components on circuit cards – loss of cards | Loss of entire EMC Interface CI | Loss of all signal processors – mission failure | II | IV | N+1 power supplies provided and monitored via ICON. |
| 5-7 Closed | Power Supply Assembly | Loss of DC power due to hardware failure | Power cannot be supplied to the EMC Interface CI | Loss of entire EMC Interface CI | Loss of all signal processors – mission failure | II | IV | N+1 power supplies provided and monitored via ICON. |
| 5-8 Closed | Power Supply Assembly | Low DC power due to hardware failure | Damage to components on circuit cards – loss of cards | Loss of entire EMC Interface CI | Loss of all signal processors – mission failure | II | IV | N+1 power supplies provided and monitored via ICON. |
| 5-9 Closed | Power Supply Assembly | Noisy DC power due to hardware failure | Damage to components on circuit cards – loss of cards | Loss of entire EMC Interface CI | Loss of all signal processors – mission failure | II | IV | N+1 power supplies provided and monitored via ICON. |

Appendix 3-B:
Beamformer (IBUG) Configuration Item
FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------------|---------------------------|---|---|--|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-1 <i>Closed</i> | Control Processor | Loss of input from EMC due to CDB Switch failure. | Loss of CDB signal | Inability to provide beamforming capability | Loss of 6 signal processors – mission failure | II | II | Provided; loss of signal detected and reported |
| 1-2 <i>Closed</i> | Control Processor | Low input signal due to CDB Switch failure | Low CDB signal | Possible inability to provide beamforming capability | Loss of 6 signal processors – mission failure | III | NA | Digital signal; not possible. |
| 1-3 <i>Closed</i> | Control Processor | Noisy input signal due to CDB Switch failure | Noisy CDB signal | Possible inability to provide beamforming capability | Loss of 6 signal processors – mission failure | III | NA | Digital signal; not possible. |
| 1-4 <i>Closed</i> | Control Processor | Loss of input from EMC due to connector failure. | Loss of CDB signal | Inability to provide beamforming capability | Loss of 6 signal processors – mission failure | II | II | Provided; loss of signal detected and reported |
| 1-5 <i>Closed</i> | Control Processor | Low input signal due to connector failure | Low CDB signal | Possible inability to provide beamforming capability | Loss of 6 signal processors – mission failure | III | NA | Digital signal; not possible. |
| 1-6 <i>Closed</i> | Control Processor | Noisy input signal due to connector failure | Noisy CDB signal | Possible inability to provide beamforming capability | Loss of 6 signal processors – mission failure | III | NA | Digital signal; not possible. |
| 1-7 <i>Closed</i> | Control Processor | Loss of control signal due to connector failure | Inability to control IBU – possible inability to process signal | Possible degradation of beamformer | Possible loss of 1 signal processor | III | III | Monitoring provided; loss of signal detected and reported. |
| 1-8 <i>Closed</i> | Control Processor | Low control signal due to connector failure | Inability to, or inadvertent control of, IBU – possible inability to process signal | Degradation of beamformer | Loss of 1 signal processor – mission failure | II | NA | Digital signal; not possible. |
| 1-9 <i>Closed</i> | Control Processor | Noisy control signal due to connector failure | Inability to, or inadvertent control of, IBU – possible inability to process signal | Degradation of beamformer | Loss of 1 signal processors – mission failure | II | NA | Digital signal; not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|--|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-10 Closed | Control Processor | Inadvertent control signal due to connector failure | Inadvertent control of IBU – possible inability to process signal | Degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Provided; signal error detected and reported. |
| 1-11 Closed | Control Processor | Loss of status signal due to connector failure | Loss of IBU status | Inability to determine condition of IBU | Inability to diagnose failures/troubleshoot – No mission effect | IV | IV | Alert provided; loss of signal detected and reported. |
| 1-12 Closed | Control Processor | Low status signal due to connector failure | Loss of or inadvertent IBU status | Inability to determine or false condition of IBU | Inability to diagnose failures/troubleshoot or false alert – No mission effect | IV | NA | Digital signal; not possible. |
| 1-13 Closed | Control Processor | Noisy status signal due to connector failure | Loss of or inadvertent IBU status | Inability to determine or false condition of IBU | Inability to diagnose failures/troubleshoot or false alert – No mission effect | IV | NA | Digital signal; not possible. |
| 1-14 Closed | Control Processor | Inadvertent status signal due to connector failure | Incorrect status of IBU | False condition of IBU | Possible loss of 1 signal processors | III | III | Alert provided; signal error detected and reported. |
| 1-15 Closed | Control Processor | Loss of control signal due to software error | Inability to redefine IBU operation – possible inability to process signal | Possible loss of one beamforming path – possible degradation of beamformer | Loss of 1 Signal Path | III | III | Monitoring and Status (M/S) provided; signal error detected and reported. |
| 1-16 Closed | Control Processor | Inadvertent control signal due to software error | Redefines IBU operation – possible inability to process signal | Loss of one beamforming path – possible degradation of beamformer | Loss of 1 IBU | II | II | M/S provided; signal error detected and reported. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|---|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-17 Closed | Control Processor | Loss of status signal due to software error | Loss of IBU status | Inability to determine condition of IBU | Inability to diagnose failures/troublesh oot – No mission effect | IV | IV | Alert provided; loss of signal detected and reported. |
| 1-18 Closed | Control Processor | Inadvertent status signal due to software error | Incorrect status of IBU | False condition of IBU | Possible loss of 6 signal processors status | III | III | Redundant checks provided; loss of signal detected and reported. |
| 1-19 Closed | Control Processor | Loss of control processor due to over temperature. | Inability to process beamformer signals | Possible loss of entire beamformer | Possible loss of 6 signal processors | III | III | Temperature monitoring provided. |
| 1-20 Closed | Control Processor | Loss of control processor due to hardware failure | Inability to process beamformer signals | Possible loss of entire beamformer | Possible loss of 6 signal processors | III | III | Periodic interface with ICON provided. |
| 1-21 Closed | Control Processor | Loss of ICON interface due to connector failure | Inability to control beamformer | Possible loss of entire beamformer | Possible loss of 6 signal processors | II | III | Redundant interface provided; loss of signal detected and reported. |
| 1-22 Closed | Control Processor | Low ICON interface due to connector failure | Inability to control or redefines beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-23 Closed | Control Processor | Noisy ICON interface due to connector failure | Inability to control or redefines beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-24 Closed | Control Processor | Inadvertent ICON interface due to connector failure | Redefines operation | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | III | Redundant interface with ICON provided; signal error detected and reported. |
| 1-25 Closed | Control Processor | Loss of ICON interface due to software error | Inability to control beamformer | Possible loss of entire beamformer | Possible loss of 6 signal processors | II | III | Redundant interface provided; signal error detected and reported. |
| 1-26 Closed | Control Processor | Inadvertent ICON interface due to software error | Redefines operation | Loss of entire beamformer | Loss of 6 signal processors | II | II | Status provided; signal error detected and reported. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|--------------------------------------|--|--|-----------------------|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-1 Closed | Fiber Channel Receiver Card | Loss of inputs from EMC due to FO Switch failure | Signals not received by IBUG | No effect | Loss of 6 signal processors – mission failure | II | II | Monitoring provided; loss of signal detected and reported. |
| 2-2 Closed | Fiber Channel Receiver Card | Loss of single input due to FO Switch failure | Loss of single GLM | No effect | Possible degradation of system. | III | III | Monitoring provided; loss of signal detected and reported. |
| 2-3 Closed | Fiber Channel Receiver Card | Low individual input signal due to FO Switch failure | Low input signal to single GLM | No effect | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 2-4 Closed | Fiber Channel Receiver Card | Low input signals due to FO Switch failure | Low input signals received by system, all GLMs | No effect | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 2-5 Closed | Fiber Channel Receiver Card | Noisy individual input signal due to FO Switch failure | Noisy input signal to single GLM | No effect | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 2-6 Closed | Fiber Channel Receiver Card | Noisy input signals due to FO Switch failure | Noisy input signals received by system, all GLMs | No effect | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 2-7 Closed | Fiber Channel Receiver Card | Incorrect signal format due to FO Switch failure | Inability to establish proper data signals | No effect | Loss of 6 signal processors – mission failure | II | II | Status provided; signal error detected and reported. |
| 2-8 Closed | Fiber Channel Receiver Card | Loss of all inputs due to connector failure | Signals not received by system | Loss of beamformer | Loss of 6 signal processors – mission failure | II | II | Status provided; signal error detected and reported. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|--------------------------------------|--|--|------------------------------|---------------------------------------|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-9 <i>Closed</i> | Fiber Channel Receiver Card | Loss of individual input due to connector failure | Loss of single GLM | Degradation of beamformer | Possible degradation of system. | III | III | Monitoring provided; loss of signal detected and reported. |
| 2-10 <i>Closed</i> | Fiber Channel Receiver Card | Low individual input signal due to connector failure | Low input signal to single GLM | Degradation of beamformer | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 2-11 <i>Closed</i> | Fiber Channel Receiver Card | Low input signals due to connector failure | Low input signals received by system, all GLMs | Degradation of beamformer | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 2-12 <i>Closed</i> | Fiber Channel Receiver Card | Noisy individual input signal due to connector failure | Noisy input signal to single GLM | Degradation of beamformer | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 2-13 <i>Closed</i> | Fiber Channel Receiver Card | Noisy input signals due to connector failure | Noisy input signals received by system, all GLMs | Degradation of beamformer | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 2-14 <i>Closed</i> | Fiber Channel Receiver Card | Loss of output due to hardware failure | Loss of single IBU input | Degradation of beamformer | Possible loss of 6 signals. | III | III | Monitoring provided; loss of signal detected and reported. |
| 2-15 <i>Closed</i> | Fiber Channel Receiver Card | Noisy output due to hardware failure | Noisy single IBU input | Degradation of beamformer | Possible loss of 6 signals | III | III | Monitoring provided; loss of signal detected and reported. |
| 2-16 <i>Closed</i> | Fiber Channel Receiver Card | Low output due to hardware failure | Low single IBU input | Degradation of beamformer | Possible degradation of system. | III | NA | Not possible. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|--------------------------------------|---|---|---|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-17 <i>Closed</i> | Fiber Channel Receiver Card | Loss of output due to connector failure | Loss of IBU inputs | Degradation of beamformer | Possible degradation of system. | III | III | Monitoring provided; loss of signal detected and reported. |
| 2-18 <i>Closed</i> | Fiber Channel Receiver Card | Noisy output due to connector failure | Noisy IBU inputs | Degradation of beamformer | Possible degradation of system. | III | III | Monitoring provided; loss of signal detected and reported. |
| 2-19 <i>Closed</i> | Fiber Channel Receiver Card | Low output due to connector failure | Low GLM outputs/IBU inputs | Degradation of beamformer | Possible degradation of system. | III | NA | Not possible. |
| 2-20 <i>Closed</i> | Fiber Channel Receiver Card | Complete FCRX failure due to bad component | Inability to process incoming signal and forward to IBUs | Loss of downconversion of input signal – complete beamformer failure | Loss of 6 signal processors – mission failure | II | II | Monitoring provided; loss of signal detected and reported. |
| 2-21 <i>Closed</i> | Fiber Channel Receiver Card | Loss of FCRX due to overtemp. | Inability to process incoming signal and forward to IBUs | Loss of downconversion of input signal – complete beamformer failure | Loss of 6 signal processors – mission failure | II | II | Temperature monitoring provided. |
| 2-22 <i>Closed</i> | Fiber Channel Receiver Card | Loss of FIFO sync. due to data format or hardware failure | Switch is made to a local oscillator | No effect | No effect | IV | NA | Not possible. |
| 2-23 <i>Closed</i> | Fiber Channel Receiver Card | Loss of power to card due to connector failure | Complete loss of card. Inability to process incoming signal | Loss of downconversion of input signal – complete beamformer failure | Loss of 6 signal processors – mission failure | II | IV | Multiple connectors provided. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|--------------------------------------|--|--|---|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-24 <i>Closed</i> | Fiber Channel Receiver Card | Low power to card due to connector failure | Loss of card. Inability to process incoming signal | Loss of downconversion of input signal – complete beamformer failure | Loss of 6 signal processors – mission failure | II | IV | Multiple connectors provided. |
| 2-25 <i>Closed</i> | Fiber Channel Receiver Card | Noisy power to card due to connector failure. | Reset or loss of card. Loss of processing of incoming signal | Loss of downconversion of input signal – complete beamformer failure | Loss of 6 signal processors – mission failure | II | IV | Filtering provided. |
| 3-1 <i>Closed</i> | Chassis | Loss of signal from FCRX to IBUs due to connector failures | Loss of one or more signals to IBU cards | Degradation of beamformer | Loss of 6 signal processors – mission failure | II | II | Monitoring provided; loss of signal detected and reported. |
| 3-2 <i>Closed</i> | Chassis | Low signal from FCRX to IBUs due to connector failures | One or more low signals to IBU cards | Degradation of beamformer | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 3-3 <i>Closed</i> | Chassis | Noisy signal from FCRX to IBU due to connector failures | One or more noisy signals to IBU cards | Degradation of beamformer | Possible degradation of system. | III | NA | Digital signal; not possible. |
| 3-4 <i>Closed</i> | Chassis | Inadvertent signal from FCRX to IBU due to connector failures | One or more incorrect signals to IBU cards | Degradation of beamformer | Possible degradation of system. | III | III | Separate signals provided; loss of signal detected and reported. |
| 3-5 <i>Closed</i> | Chassis | Loss of signal from FCRX to IBUs due to backplane failures | Loss of one or more signals to IBU cards | Degradation of beamformer | Loss of 12 signal processors – mission failure | II | NA | Failure not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|---------------------------|--|--|--|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 3-6 <i>Closed</i> | Chassis | Low signal from FCRX to IBUs due to backplane failures | One or more low signals to IBU cards | Degradation of beamformer | Possible degradation of system. | III | NA | Failure not possible. |
| 3-7 <i>Closed</i> | Chassis | Noisy signal from FCRX to IBU due to backplane failures | One or more noisy signals to IBU cards | Degradation of beamformer | Possible degradation of system. | III | NA | Failure not possible. |
| 3-8 <i>Closed</i> | Chassis | Inadvertent signal from FCRX to IBU due to backplane failures | One or more incorrect signals to IBU cards | Degradation of beamformer | Possible degradation of system. | III | NA | Failure not possible. |
| 3-9 <i>Closed</i> | Chassis | Loss of all data signals due to catastrophic backplane failure | Loss of all signals to IBU card | Loss of downconverter signal | Loss of 6 signal processors – mission failure | II | NA | Failure not possible. |
| 3-10 <i>Closed</i> | Chassis | Loss of control signal due to connector failure | Loss of beamformer control | Inability to change beamformer setup | Possible loss of 6 signal processors | III | III | M/S provided; loss of signal detected and reported. |
| 3-11 <i>Closed</i> | Chassis | Low control signal due to connector failure | Loss of or inadvertent beamformer control | Inability to or premature change of beamformer setup | Loss of 6 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 3-12 <i>Closed</i> | Chassis | Noisy control signal due to connector failure | Loss of or inadvertent beamformer control | Inability to or premature change of beamformer setup | Loss of 6 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 3-13 <i>Closed</i> | Chassis | Inadvertent control signal due to connector failure | Incorrect setup of beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | II | M/S provided; signal error detected and reported. |
| 3-14 <i>Closed</i> | Chassis | Loss of control signal due to backplane failure | Loss of beamformer control | Inability to change beamformer setup | Possible loss of 6 signal processors | III | NA | Failure not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|---------------------------|---|---|---|--|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 3-15 <i>Closed</i> | Chassis | Low control signal due to backplane failure | Loss of or inadvertent beamformer control | Inability to or premature change of beamformer setup | Loss of 6 signal processors – mission failure | II | NA | Failure not possible. |
| 3-16 <i>Closed</i> | Chassis | Noisy control signal due to backplane failure | Loss of or inadvertent beamformer control | Inability to or premature change of beamformer setup | Loss of 6 signal processors – mission failure | II | NA | Failure not possible. |
| 3-17 <i>Closed</i> | Chassis | Inadvertent control signal due to backplane failure | Incorrect setup of beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | NA | Failure not possible. |
| 3-18 <i>Closed</i> | Chassis | Loss of status signal due to connector failure | Loss of beamformer status | Inability to determine condition of beamformer | Inability to diagnose failures/troubleshoot – No mission effect | IV | IV | Control will detect loss of signal. |
| 3-19 <i>Closed</i> | Chassis | Low status signal due to connector failure | Loss of or inadvertent beamformer status | Inability to determine or false condition of beamformer setup | Inability to diagnose failures/troubleshoot or false alert – No mission effect | IV | NA | Digital signal; not possible. |
| 3-20 <i>Closed</i> | Chassis | Noisy status signal due to connector failure | Loss of or inadvertent beamformer status | Inability to determine or false condition of beamformer | Inability to diagnose failures/troubleshoot or false alert – No mission effect | IV | NA | Digital signal; not possible. |
| 3-21 <i>Closed</i> | Chassis | Inadvertent status signal due to connector failure | Incorrect status of beamformer | False condition of beamformer | Possible loss of 1 signal processor | III | IV | Separate signals provided; signal error detected and reported. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|---------------------------|--|---|---|--|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 3-22 <i>Closed</i> | Chassis | Loss of status signal due to backplane failure | Loss of beamformer status | Inability to determine condition of beamformer | Inability to diagnose failures/troubleshoot – No mission effect | IV | NA | Failure not possible. |
| 3-23 <i>Closed</i> | Chassis | Low status signal due to backplane failure | Loss of or inadvertent beamformer status | Inability to determine or false condition of beamformer | Inability to diagnose failures/troubleshoot or false alert – No mission effect | IV | NA | Failure not possible. |
| 3-24 <i>Closed</i> | Chassis | Noisy status signal due to backplane failure | Loss of or inadvertent beamformer status | Inability to determine or false condition of beamformer | Inability to diagnose failures/troubleshoot or false alert – No mission effect | IV | NA | Failure not possible. |
| 3-25 <i>Closed</i> | Chassis | Inadvertent status signal due to backplane failure | Incorrect status of beamformer | False condition of beamformer | Possible loss of two signal processors | III | NA | Failure not possible. |
| 3-26 <i>Closed</i> | Chassis | Loss of power due to backplane connector failure | Loss of power to one or more cards. | Inability to operate beamformer | Loss of 6 signal processors – mission failure | II | II | N+1 redundancy provided. Power status monitored by ICON. |
| 3-27 <i>Closed</i> | Chassis | Low power due to backplane connector failure | Loss of power to one or more cards. | Inability to operate beamformer | Loss of 6 signal processors – mission failure | II | II | N+1 redundancy provided. Power status monitored by ICON. |
| 3-28 <i>Closed</i> | Chassis | Noisy power due to backplane connector failure | Reset or loss of one or more cards. Loss of processing of incoming signal | Inability to operate beamformer | Loss of 6 signal processors – mission failure | II | II | N+1 redundancy provided. Power status monitored by ICON. |
| 4-1 <i>Closed</i> | IBU Card | Loss of input due to connector failure | Complete signal not received by IBU | Degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Monitoring provided; loss of signal detected and reported. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|---------------------------|---|---|--|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 4-2 Closed | IBU Card | Low input due to connector failure | Complete signal not received by IBU | Degradation of beamformer | Possible degradation of system. | III | NA | Failure not possible. |
| 4-3 Closed | IBU Card | Noisy input due to connector failure | Complete signal not received by IBU | Degradation of beamformer | Possible degradation of system. | III | III | Monitoring is provided; signal error detected and reported. |
| 4-4 Closed | IBU Card | Loss of control signal due to connector failure | Inability to control IBU – possible inability to process signal | Possible degradation of beamformer | Possible loss of 1 signal processor | III | III | M/S provided; loss of signal detected and reported. |
| 4-5 Closed | IBU Card | Low control signal due to connector failure | Inability to or inadvertent control of IBU – possible inability to process signal | Degradation of beamformer | Loss of 1 signal processor – mission failure | II | NA | Failure not possible. |
| 4-6 Closed | IBU Card | Noisy control signal due to connector failure | Inability to or inadvertent control of IBU – possible inability to process signal | Degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Signal error detected and reported. |
| 4-7 Closed | IBU Card | Inadvertent control signal due to connector failure | Inadvertent control of IBU – possible inability to process signal | Degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | M/S provided; signal error detected and reported. |
| 4-8 Closed | IBU Card | Loss of status signal due to connector failure | Loss of IBU status | Inability to determine condition of IBU | Inability to diagnose failures/troubleshoot – No mission effect | IV | IV | Control will detect loss of signal. |
| 4-9 Closed | IBU Card | Low status signal due to connector failure | Loss of or inadvertent IBU status | Inability to determine or false condition of IBU | Inability to diagnose failures/troubleshoot or false alert – No mission effect | IV | NA | Failure not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|---------------------------------------|---|--|----------------------|----|---|
| | | | Local | NHA | End | I | F | |
| 4-10 Closed | IBU Card | Noisy status signal due to connector failure | Loss of or inadvertent IBU status | Inability to determine or false condition of IBU | Inability to diagnose failures/troubleshoot or false alert – No mission effect | IV | IV | Accepted. |
| 4-11 Closed | IBU Card | Inadvertent status signal due to connector failure | Incorrect status of IBU | False condition of IBU | Possible loss of 1 signal processor | III | IV | Separate signals provided; signal error detected and reported. |
| 4-12 Closed | IBU Card | Loss of IBU due to overtemp. | Inability to process signal | Loss of one beamforming path; degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Temperature monitoring provided. |
| 4-13 Closed | IBU Card | Loss of output signal due to connector failure | Loss of IBU output signal | Loss of one beamforming path; degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Monitoring provided; loss of signal detected and reported by DMG. |
| 4-14 Closed | IBU Card | Low output signal due to connector failure | Loss of or unusable IBU output signal | Loss of one beamforming path; degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Monitoring provided; signal error detected and reported. |
| 4-15 Closed | IBU Card | Noisy output signal due to connector failure | Unusable IBU output signal | Loss of one beamforming path; degradation of beamformer | Loss of 1 signal processors – mission failure | II | II | Monitoring provided; Signal error detected and reported. |
| 4-16 Closed | IBU Card | Loss of output signal due to hardware failure | Loss of IBU output signal | Loss of one beamforming path; degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Monitoring provided; loss of signal detected and reported. |
| 4-17 Closed | IBU Card | Low output signal due to hardware failure | Loss of or unusable IBU output signal | Loss of one beamforming path; degradation of beamformer | Loss of 1 signal processors – mission failure | II | II | Monitoring provided. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|---|---|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 4-18 Closed | IBU Card | Noisy output signal due to hardware failure | Unusable IBU output signal | Loss of one beamforming path; degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Signal error detected and reported. |
| 4-19 Closed | IBU Card | Complete IBU failure due to bad component | Inability to process signal | Loss of one beamforming path; degradation of beamformer | Loss of 1 signal processor – mission failure | II | II | Monitoring provided; loss of signal detected and reported. |
| 4-20 Closed | IBU Card | Loss of power to card due to connector failure | Complete loss of card. Inability to process incoming signal | Loss of signal – complete IBU failure | Loss of 1 signal processor – mission failure | II | III | Multiple connectors provided; loss of signal detected and reported. |
| 4-21 Closed | IBU Card | Low power to card due to connector failure | Loss of card. Inability to process incoming signal | Loss of signal – complete IBU failure | Loss of 1 signal processor – mission failure | II | III | Multiple connectors provided; loss of signal detected and reported. |
| 4-22 Closed | IBU Card | Noisy power to card due to connector failure. | Reset or loss of card. Loss of processing of incoming signal | Loss of signal – complete IBU failure | Loss of 1 signal processor – mission failure | II | II | Loss of signal detected and reported. |
| 5-1 Closed | Fan Assembly | Loss of power due to connector failure | Fan shuts down | Possible loss of entire beamformer | Possible loss of 6 signal processors | II | II | Fan operation monitored by temp sensors in IBUG. |
| 5-2 Closed | Fan Assembly | Low power due to connector failure | Motor burns up - fan shuts down | Possible loss of entire beamformer | Possible loss of 6 signal processors | III | NA | Failure not possible; AC power. |
| 5-3 Closed | Fan Assembly | Noisy power due to connector failure | Possible motor problems resulting in the fan shutting down | Possible loss of entire beamformer | Possible loss of 6 signal processors | III | NA | Failure not possible; AC power. |
| 5-4 Closed | Fan Assembly | Hardware failure | Fan shuts down | Possible loss of entire beamformer | Possible loss of 6 signal processors | II | II | Fan operation monitored by temp sensors in IBUG. |
| 6-1 Closed | Power Supply Assembly | Loss of supply power to IBUG | Power cannot be supplied to the beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |
| 6-2 Closed | Power Supply Assembly | Low supply power to IBUG | Power supplies shut down and power cannot be supplied to the beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------------|-----------------------------|---|--|------------------------------|---|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 6-3 <i>Closed</i> | Power Supply Assembly | Noisy supply power to IBUG | Power supplies shut down and power cannot be supplied to the beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |
| 6-4 <i>Closed</i> | Power Supply Assembly | Loss of DC power due to connector failure | Power cannot be supplied to the beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |
| 6-5 <i>Closed</i> | Power Supply Assembly | Low DC power due to connector failure | Damage to components on circuit cards – loss of cards | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |
| 6-6 <i>Closed</i> | Power Supply Assembly | Noisy DC power due to connector failure | Damage to components on circuit cards – loss of cards | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |
| 6-7 <i>Closed</i> | Power Supply Assembly | Loss of DC power due to hardware failure | Power cannot be supplied to the beamformer | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |
| 6-8 <i>Closed</i> | Power Supply Assembly | Low DC power due to hardware failure | Damage to components on circuit cards – loss of cards | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |
| 6-9 <i>Closed</i> | Power Supply Assembly | Noisy DC power due to hardware failure | Damage to components on circuit cards – loss of cards | Loss of entire beamformer | Loss of 6 signal processors – mission failure | II | IV | N+1 power supplies provided and monitored by ICON. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

Appendix 3-C:
IBUG Controller (ICON) Configuration Item
FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|------------------------|--|--|--|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-1 Closed | ICON Server | Loss of ICON Ethernet Hub interface due to connector failure | Loss of ICON Ethernet Hub interface | Loss of ICON/IBUG control | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 1-2 Closed | ICON Server | Low ICON Ethernet Hub interface due to connector failure | Low ICON Ethernet Hub interface | Loss of, or inadvertent IBU control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-3 Closed | ICON Server | Noisy ICON Ethernet Hub interface due to connector failure | Noisy ICON Ethernet Hub interface | Loss of, or inadvertent IBU control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-4 Closed | ICON Server | Inadvertent ICON Ethernet Hub interface due to connector failure | Incorrect ICON Ethernet Hub interface | Inadvertent IBU control – redefines IBUG | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-5 Closed | ICON Server | Loss of ICON Ethernet Hub interface due to hardware failure | Loss of ICON Ethernet Hub interface | Loss of ICON/IBUG control | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 1-6 Closed | ICON Server | Low ICON Ethernet Hub interface due to hardware failure | Low ICON Ethernet Hub interface | Loss of, or inadvertent IBU control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-7 Closed | ICON Server | Noisy ICON Ethernet Hub interface due to hardware failure | Noisy ICON Ethernet Hub interface | Loss of, or inadvertent IBU control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-8 Closed | ICON Server | Inadvertent ICON Ethernet Hub interface due to hardware failure | Incorrect ICON Ethernet Hub interface | Inadvertent IBU control – redefines IBUG | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-9 Closed | ICON Server | Loss of control signal due to software error | Possible inability to control IBUG interface signals | Possible degradation of IBUG Interface | Possible loss of all signal processors | III | III | ICON Server requests status on a periodic basis. |
| 1-10 Open | ICON Server | Inadvertent control signal due to software error | Redefines IBUG Interface operation | Degradation of IBUG Interface | Loss of all signal processors – mission failure | II | III | Provide monitoring/ feedback for all control commands. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|------------------------------------|--|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-11 Closed | ICON Server | Loss of status signal due to software error | Loss of IBUG Interface status | Inability to determine condition of IBUG Interface | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | ICON Server requests status on a periodic basis. |
| 1-12 Closed | ICON Server | Inadvertent status signal due to software error | Incorrect status of IBUG Interface | False condition of IBUG Interface | Possible loss of two signal processors | III | III | ICON Server requests status on a periodic basis. |
| 1-13 Closed | ICON Server | Loss of DASCON Ethernet Hub interface due to connector failure | Loss of DASCON interface | Loss of ICON/IBUG control | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 1-14 Closed | ICON Server | Low DASCON Ethernet Hub interface due to connector failure | Low DASCON interface | Loss of, or inadvertent IBU control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-15 Closed | ICON Server | Noisy DASCON Ethernet Hub interface due to connector failure | Noisy DASCON interface | Loss of, or inadvertent IBU control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-16 Closed | ICON Server | Inadvertent DASCON Ethernet Hub interface due to connector failure | Incorrect DASCON interface | Inadvertent IBU control – redefines IBUG | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-17 Closed | ICON Server | Loss of DASCON Ethernet Hub interface due to hardware failure | Loss of DASCON interface | Loss of ICON/IBUG control | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 1-18 Closed | ICON Server | Low DASCON Ethernet Hub interface due to hardware failure | Low DASCON interface | Loss of, or inadvertent IBU control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-19 Closed | ICON Server | Noisy DASCON Ethernet Hub interface due to hardware failure | Noisy DASCON interface | Loss of, or inadvertent IBU control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|---|---|--|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-20 Closed | ICON Server | Inadvertent DASCON Ethernet Hub interface due to hardware failure | Incorrect DASCON interface | Inadvertent IBU control – redefines IBUG | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 1-21 Closed | ICON Server | Loss of Time source input due to connector failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp capability | III | IV | Internal clock in ICON is capable of providing time stamp for limited time. Monitoring and alert provided when lost. |
| 1-22 Closed | ICON Server | Loss of Time source input due to hardware failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp capability | III | IV | Internal clock in ICON is capable of providing time stamp for limited time. Monitoring and alert provided when lost. |
| 1-23 Open | ICON Server | Loss of fan due to power connector failure | Fan shuts down | Possible loss of ICON Server | Loss of operator control. | III | III | ICON Server monitors fan operation. |
| 1-24 Open | ICON Server | Loss of fan due to hardware failure | Fan shuts down | Possible loss of ICON Server | Loss of operator control. | III | III | ICON Server monitors fan operation. |
| 1-25 Closed | ICON Server | Loss of input power due to connector failure | Power cannot be supplied to the ICON Server | Loss of ICON Server | Loss of operator control. | III | IV | Loss of ICON power detected by DASCON. N+1 power supplies provided |
| 1-26 Closed | ICON Server | Low input power due to connector failure | Damage to components in ICON Server | Loss of ICON Server | Possible loss of all signal processors - Loss of Operator Interface Control. | III | IV | ICON server monitors power supply operation. N+1 power supplies provided. |
| 1-27 Closed | ICON Server | Noisy input power due to connector failure | Damage to components in ICON Server | Loss of ICON Server | Possible loss of all signal processors - Loss of Operator Interface Control | III | IV | ICON server monitors power supply operation. N+1 power supplies provided. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|---|--|------------------------------------|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-28 Closed | ICON Server | Loss of power due to hardware failure | Power cannot be supplied to the ICON Server | Loss of ICON Server | Loss of operator interface control from front panel. | III | IV | User requests status on a periodic basis. ICON Server monitors power supply operation. N+1 power supplies provided |
| 1-29 Closed | ICON Server | Low power due to hardware failure | Damage to components in ICON Server | Loss of ICON Server | Possible loss of all signal processors - Loss of Operator Interface Control | III | IV | ICON server monitors power supply operation. N+1 power supplies provided. |
| 1-30 Closed | ICON Server | Noisy power due to hardware failure | Damage to components in ICON Server | Loss of ICON Server | Possible loss of all signal processors - Loss of Operator Interface Control | III | IV | ICON server monitors power supply operation. N+1 power supplies provided. |
| 2-1 Closed | ICON Ethernet Hub | Loss of IBUG interface due to connector failure | Inability to control beamformer | Possible loss of entire beamformer | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 2-2 Closed | ICON Ethernet Hub | Low IBUG interface due to connector failure | Inability to control or redefines beamformer | Loss of entire beamformer | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-3 Closed | ICON Ethernet Hub | Noisy IBUG interface due to connector failure | Inability to control or redefines beamformer | Loss of entire beamformer | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-4 Closed | ICON Ethernet Hub | Inadvertent IBUG interface due to connector failure | Redefines operation | Loss of entire beamformer | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-5 Closed | ICON Ethernet Hub | Loss of IBUG interface due to hardware failure | Loss of IBUG control signal | Inability to control IBUG | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 2-6 Closed | ICON Ethernet Hub | Low IBUG interface due to hardware failure | Low IBUG control signal | Inability to control IBUG | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|---|---|--|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-7 Closed | ICON Ethernet Hub | Noisy IBUG interface due to hardware failure | Noisy IBUG control signal | Inability to control or redefines IBUG | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-8 Closed | ICON Ethernet Hub | Inadvertent IBUG interface due to hardware failure | Inadvertent IBUG control signal | Redefines IBUG | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-9 Closed | ICON Ethernet Hub | Loss of IBUG interface due to software error | Inability to control beamformer | Possible loss of entire beamformer | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 2-10 Open | ICON Ethernet Hub | Inadvertent IBUG interface due to software error | Redefines operation | Loss of entire beamformer | Loss of 8 signal processors – mission failure | II | II | Provide feedback on all control commands. |
| 2-11 Closed | ICON Ethernet Hub | Loss of EMC Interface control signal due to connector failure | Inability to control EMC interface - possible inability to process signals | Possible degradation of EMC Interface | Possible loss of all signal processors | III | III | ICON Server requests status on a periodic basis. |
| 2-12 Closed | ICON Ethernet Hub | Low EMC Interface control signal due to connector failure | Inability or inadvertent control of EMC interface - possible inability to process EMC interface signals | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-13 Closed | ICON Ethernet Hub | Noisy EMC Interface control signal due to connector failure | Inability or inadvertent control of EMC interface - possible inability to process EMC interface signals | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | NA | Digital signal; not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|---|---|---|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-14 Closed | ICON Ethernet Hub | Inadvertent EMC Interface control signal due to connector failure | Redefines EMC Interface operation | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-15 Closed | ICON Ethernet Hub | Loss of EMC Interface control signal due to hardware failure | Inability to control EMC interface - possible inability to process signals | Possible degradation of EMC Interface | Possible loss of all signal processors | III | III | ICON Server requests status on a periodic basis. |
| 2-16 Closed | ICON Ethernet Hub | Low EMC Interface control signal due to hardware failure | Inability or inadvertent control of EMC interface - possible inability to process EMC interface signals | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-17 Closed | ICON Ethernet Hub | Noisy EMC Interface control signal due to hardware failure | Inability or inadvertent control of EMC interface - possible inability to process EMC interface signals | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-18 Closed | ICON Ethernet Hub | Inadvertent EMC Interface control signal due to hardware failure | Redefines EMC Interface operation | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-19 Closed | ICON Ethernet Hub | Loss of EMC Interface status signal due to connector failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Provide alert indicating loss of status. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|---|---|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-20 Closed | ICON Ethernet Hub | Low EMC Interface status signal due to connector failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Digital signal; not possible. |
| 2-21 Closed | ICON Ethernet Hub | Noisy EMC Interface status signal due to connector failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Digital signal; not possible. |
| 2-22 Closed | ICON Ethernet Hub | Inadvertent EMC Interface status signal due to connector failure | Incorrect status of EMC Interface | False condition of EMC Interface | Possible loss of all signal processors | III | NA | Digital signal; not possible. |
| 2-23 Closed | ICON Ethernet Hub | Loss of EMC Interface status signal due to hardware failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Provide alert indicating loss of status. |
| 2-24 Closed | ICON Ethernet Hub | Low EMC Interface status signal due to hardware failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Digital signal; not possible. |
| 2-25 Closed | ICON Ethernet Hub | Noisy EMC Interface status signal due to hardware failure | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Digital signal; not possible. |
| 2-26 Closed | ICON Ethernet Hub | Inadvertent EMC Interface status signal due to hardware failure | Incorrect status of EMC Interface | False condition of EMC Interface | Possible loss of all signal processors | III | NA | Digital signal; not possible. |
| 2-27 Closed | ICON Ethernet Hub | Loss of control signal due to software error | Possible inability to control EMC interface signals | Possible degradation of EMC Interface | Possible loss of all signal processors | III | III | ICON Server requests status on a periodic basis. |
| 2-28 Open | ICON Ethernet Hub | Inadvertent control signal due to software error | Redefines EMC Interface operation | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | III | Provide monitoring/ feedback for all control commands. |

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Note 1: “T” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|--|---|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-29 Closed | ICON Ethernet Hub | Loss of status signal due to software error | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Provide alert indicating loss of status. |
| 2-30 Open | ICON Ethernet Hub | Inadvertent status signal due to software error | Incorrect status of EMC Interface | False condition of EMC Interface | Possible loss of two signal processors | III | III | Provide redundant checks to verify status signal |
| 2-31 Closed | ICON Ethernet Hub | Loss of ICON Server interface due to connector failure | Loss of ICON Server interface | Inability to control ICON Server , inability to receive message | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 2-32 Closed | ION Ethernet Hub | Low ICON Server interface due to connector failure | Low ICON Server control signal | Inability to control or redefines ICON Server | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-33 Closed | ICON Ethernet Hub | Noisy ICON Server interface due to connector failure | Noisy ICON Server control signal | Inability to control or redefines ICON Server | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-34 Closed | ICON Ethernet Hub | Inadvertent ICON Server interface due to connector failure | Inadvertent ICON Server control signal | Redefines ICON Server | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-35 Closed | ICON Ethernet Hub | Loss of ICON Server interface due to hardware failure | Loss of ICON Server interface | Inability to control ICON Server , inability to receive message | Possible loss of 8 signal processors | III | III | ICON Server requests status on a periodic basis. |
| 2-36 Closed | ICON Ethernet Hub | Low ICON Server interface due to hardware failure | Low ICON Server control signal | Inability to control or redefines ICON Server | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-37 Closed | ICON Ethernet Hub | Noisy ICON Server interface due to hardware failure | Noisy ICON Server control signal | Inability to control or redefines ICON Server | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |
| 2-38 Closed | ICON Ethernet Hub | Inadvertent ICON Server interface due to hardware failure | Inadvertent ICON Server control signal | Redefines ICON Server | Loss of 8 signal processors – mission failure | II | NA | Digital signal; not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

Appendix 3-D:
IF Switch Configuration Item
FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|---------------------------|---|---|-----------|---|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 1-1 Closed | IF Switch | Loss of inputs due to IBUG Interconnect failure | Data signals not received by switch | No effect | Loss of 10 signal processors – mission failure | II | II | Signal strength measured at DMG input. Sensed and reported at DMG. Automatic sensing and switchover. |
| 1-2 Closed | IF Switch | Low inputs due to IBUG Interconnect failure | Low signals received by switch | No effect | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-3 Closed | IF Switch | Noisy inputs due to IBUG Interconnect failure | Noisy signals received by switch | No effect | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-4 Closed | IF Switch | Loss of single input due to IBUG Interconnect failure | Single data signal not received by switch | No effect | Loss of one signal processor. | II | II | Signal strength measured at DMG input. Sensed and reported at DMG. Automatic sensing and switchover. |
| 1-5 Closed | IF Switch | Low single input due to IBUG Interconnect failure | Single low data signal received by switch | No effect | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-6 Closed | IF Switch | Noisy single input due to IBUG Interconnect failure | Single noisy data signal received by switch | No effect | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-7 Closed | IF Switch | Loss of single input due to connector failure | Single data signal not received by switch | No effect | Loss of one signal processor. | II | II | Signal strength measured at DMG input. Sensed and reported at DMG. Automatic sensing and switchover. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|-----------------------|---|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 1-8 Closed | IF Switch | Low single input due to connector failure | Single low data signal received by switch | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-9 Closed | IF Switch | Noisy single input due to connector failure | Single noisy data signal received by switch | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-10 Closed | IF Switch | Loss of single output due to connector failure | Loss of data signal to DMU | No effect. | Loss of one signal processor. | II | II | Signal strength measured at DMG input. Automatic sensing and switchover. |
| 1-11 Closed | IF Switch | Low single output due to connector failure | Loss of or unusable low output signal to DMU | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-12 Closed | IF Switch | Noisy single output due to connector failure | Unusable output signal to DMU. | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-13 Closed | IF Switch | Loss of single output due to Input Card failure | Loss of data signal to DMU | No effect. | Loss of one or more signal processors. | II | II | Signal strength measured at DMG input. Automatic sensing and switchover. |
| 1-14 Closed | IF Switch | Low single output due to Input Card failure | Loss of or unusable low output signal to DMU | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-15 Closed | IF Switch | Noisy single output due to Input Card failure | Unusable output signal to DMU. | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|---|-----------------------|--|----------------------|----|---|
| | | | Local | NHA | End | I | F | |
| 1-16 Closed | IF Switch | Inadvertent single output due to Input Card failure | Incorrect output signal to DMU | Loss of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-17 Open | IF Switch | Loss of multiple outputs due to Input Card failure | Loss of data signals to DMU | No effect. | Loss of eight signal processors – mission failure | II | II | Signal losses sensed and reported out by DMG, auto-switching to an unused IBUG would mitigate this problem. |
| 1-18 Closed | IF Switch | Low multiple outputs due to Input Card failure | Loss of or unusable low output signals to DMU | Degradation of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-19 Closed | IF Switch | Noisy multiple outputs due to Input Card failure | Unusable output signals to DMU. | Degradation of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-20 Closed | IF Switch | Inadvertent multiple outputs due to Input Card failure | Incorrect output signals to DMU | Loss of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-21 Closed | IF Switch | Loss of single output due to Output Card failure | Loss of data signal to DMU | No effect. | Loss of one signal processor. | II | II | Signal strength measured at DMG input. Automatic sensing and switchover. |
| 1-22 Closed | IF Switch | Low single output due to Output Card failure | Loss of or unusable low output signal to DMU | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-23 Closed | IF Switch | Noisy single output due to Output Card failure | Unusable output signal to DMU. | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|-----------------------|--|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 1-24 Closed | IF Switch | Inadvertent single output due to Output Card failure | Incorrect output signal to DMU | Loss of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-25 Open | IF Switch | Loss of multiple outputs due to Output Card failure | Loss of data signals to DMU | No effect. | Loss of eight signal processors – mission failure | II | II | Signal losses sensed and reported by DMG, auto-switchover to unused DMG would mitigate this problem. |
| 1-26 Closed | IF Switch | Low multiple outputs due to Output Card failure | Loss of or unusable low output signals to DMU | Degradation of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-27 Closed | IF Switch | Noisy multiple outputs due to Output Card failure | Unusable output signals to DMU. | Degradation of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-28 Closed | IF Switch | Inadvertent multiple outputs due to Output Card failure | Incorrect output signals to DMU | Loss of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-29 Closed | IF Switch | Loss of single output due to Switch Matrix failure | Loss of data signal to DMU | No effect. | Loss of one or more signal processors. | II | II | Automatic sensing and switchover. |
| 1-30 Closed | IF Switch | Low single output due to Switch Matrix failure | Loss of or unusable low output signal to DMU | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-31 Closed | IF Switch | Noisy single output due to Switch Matrix failure | Unusable output signal to DMU. | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|-----------------------|--|----------------------|----|---|
| | | | Local | NHA | End | I | F | |
| 1-32 Closed | IF Switch | Inadvertent single output due to Switch Matrix failure | Incorrect output signal to DMU | Loss of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-33 Closed | IF Switch | Loss of some or all outputs due to Switch Matrix failure | Loss of data signals to DMU | Loss of switch | Loss of 64 signal processors – mission failure | II | II | Signal losses sensed and reported by DMG, IF Switch might need replacement. |
| 1-34 Closed | IF Switch | Low multiple outputs due to Switch Matrix failure | Loss of or unusable low output signals to DMU | Degradation of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-35 Closed | IF Switch | Noisy multiple outputs due to Switch Matrix failure | Unusable output signals to DMU. | Degradation of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-36 Closed | IF Switch | Inadvertent multiple outputs due to Switch Matrix failure | Incorrect output signals to DMU | Loss of switch | Loss of multiple signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-37 Closed | IF Switch | Loss of all outputs due to Switch Matrix failure | Loss of all data signals to DMU | Loss of switch | Loss of 64 signal processors – mission failure | II | II | Signal losses sensed and reported by DMG, IF Switch might need replacement. |
| 1-38 Closed | IF Switch | All outputs low due to Switch Matrix failure | All output signals lost or unusable low to DMU | Degradation of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-39 Closed | IF Switch | All outputs noisy due to Switch Matrix failure | Unusable output signals to DMU. | Degradation of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-40 Closed | IF Switch | All inadvertent outputs due to Switch Matrix failure | Incorrect output signals to DMU | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|---|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-41 Closed | IF Switch | Loss of control signal with Input Card due to connector failure | Inability to control switch – possible inability to switch signals | Possible degradation of switch | Possible loss of one or more signal processors | III | III | DCON requests status on a periodic basis. Error would be sensed and reported by DCON. |
| 1-42 Closed | IF Switch | Low control signal with Input Card due to connector failure | Inability to or inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-43 Closed | IF Switch | Noisy control signal with Input Card due to connector failure | Inability to or inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-44 Closed | IF Switch | Inadvertent control signal with Input Card due to connector failure | Inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-45 Closed | IF Switch | Loss of status signal with Input Card due to connector failure | Loss of switch input status | Inability to determine condition of Input Card | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | DCON requests status on a periodic basis. |
| 1-46 Closed | IF Switch | Low status signal with Input Card due to connector failure | Loss of or inadvertent switch input status | Inability to determine or false condition of Input Card | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|--|---|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-47 Closed | IF Switch | Noisy status signal with Input Card due to connector failure | Loss of or inadvertent switch input status | Inability to determine or false condition of Input Card | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid Failure Mode |
| 1-48 Closed | IF Switch | Inadvertent status signal with Input Card due to connector failure | Inadvertent switch input status | False condition of Input Card | Possible loss of 10 signal processors | III | NA | Invalid Failure Mode |
| 1-49 Closed | IF Switch | Loss of control signal with Output Card due to connector failure | Inability to control switch – possible inability to switch signals | Possible degradation of switch | Possible loss of eight signal processors | III | III | DCON requests status on a periodic basis. Error would be sensed and reported by DCON. |
| 1-50 Closed | IF Switch | Low control signal with Output Card due to connector failure | Inability to or inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-51 Closed | IF Switch | Noisy control signal with Output Card due to connector failure | Inability to or inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-52 Closed | IF Switch | Inadvertent control signal with Output Card due to connector failure | Inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|--|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-53 Closed | IF Switch | Loss of status signal with Output Card due to connector failure | Loss of switch output status | Inability to determine condition of Output Card | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | DCON requests status on a periodic basis. |
| 1-54 Closed | IF Switch | Low status signal with Output Card due to connector failure | Loss of or inadvertent switch output status | Inability to determine or false condition of Output Card | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid Failure Mode |
| 1-55 Closed | IF Switch | Noisy status signal with Output Card due to connector failure | Loss of or inadvertent switch output status | Inability to determine or false condition of Output Card | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid Failure Mode |
| 1-56 Closed | IF Switch | Inadvertent status signal with Output Card due to connector failure | Inadvertent switch output status | False condition of Output Card | Possible loss of 10 signal processors | III | NA | Invalid Failure Mode |
| 1-57 Closed | IF Switch | Loss of control signal with Switch Matrix due to connector failure | Inability to control switch – possible inability to switch signals | Possible degradation of switch | Possible loss of 64 signal processors. | III | III | DCON requests status on a periodic basis. Error would be sensed and reported by DCON. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|--|--|---|----------------------|----|---|
| | | | Local | NHA | End | I | F | |
| 1-58 Closed | IF Switch | Low control signal with Switch Matrix due to connector failure | Inability to or inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-59 Closed | IF Switch | Noisy control signal with Switch Matrix due to connector failure | Inability to or inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-60 Closed | IF Switch | Inadvertent control signal with Switch Matrix due to connector failure | Inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of two signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-61 Closed | IF Switch | Loss of status signal with Switch Matrix due to connector failure | Loss of switch matrix status | Inability to determine condition of Switch Matrix | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | DCON requests status on a periodic basis. |
| 1-62 Closed | IF Switch | Low status signal with Switch Matrix due to connector failure | Loss of or inadvertent switch matrix status | Inability to determine or false condition of Switch Matrix | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|--|---|----------------------|----|-----------------------|
| | | | Local | NHA | End | I | F | |
| 1-63 Closed | IF Switch | Noisy status signal with Switch Matrix due to connector failure | Loss of or inadvertent switch matrix status | Inability to determine or false condition of Switch Matrix | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid Failure Mode |
| 1-64 Closed | IF Switch | Inadvertent status signal with Switch Matrix due to connector failure | Inadvertent switch matrix status | False condition of Switch Matrix | Possible loss of 10 signal processors | III | NA | Invalid Failure Mode |
| 1-65 Closed | IF Switch | Loss of control signal with Power Supply due to connector failure | Inability to operate switch – possible inability to switch signals | Possible degradation of switch | Possible loss of 10 signal processors | III | NA | Invalid Failure Mode |
| 1-66 Closed | IF Switch | Low control signal with Power Supply due to connector failure | Inability to or inadvertent operation of switch– possible inability to switch signals | Degradation of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-67 Closed | IF Switch | Noisy control signal with Power Supply due to connector failure | Inability to or inadvertent operation of switch– possible inability to switch signals | Degradation of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|---|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-68 Closed | IF Switch | Inadvertent control signal with Power Supply due to connector failure | Inadvertent operation of switch – possible inability to switch signals | Degradation of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-69 Closed | IF Switch | Loss of status signal with Power Supply due to connector failure | Loss of switch power supply status | Inability to determine condition of Power Supply | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | DCON requests status on a periodic basis. |
| 1-70 Closed | IF Switch | Low status signal with Power Supply due to connector failure | Loss of or inadvertent switch power supply status | Inability to determine or false condition of Power Supply | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid Failure Mode |
| 1-71 Closed | IF Switch | Noisy status signal with Power Supply due to connector failure | Loss of or inadvertent switch power supply status | Inability to determine or false condition of Power Supply | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid Failure Mode |
| 1-72 Closed | IF Switch | Inadvertent status signal with Power Supply due to connector failure | Inadvertent switch power supply status | False condition of Power Supply | Possible loss of 10 signal processors | III | NA | Invalid Failure Mode |
| 1-73 Closed | IF Switch | Loss of RS-232 controller due to hardware failure | Inability to control switch – possible inability to switch signals | Possible degradation of switch | Possible loss of 64 signal processors | III | III | DCON requests status on a periodic basis. Error would be sensed and reported by DCON. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|--|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-74 Closed | IF Switch | Loss of control signal due to software error | Inability to control switch – possible inability to switch signals | Possible degradation of switch | Possible loss of 64 signal processors | III | III | Provide monitoring/ feedback for all control commands. Automatic sensing and switchover. |
| 1-75 Closed | IF Switch | Inadvertent control signal due to software error | Inadvertent control of switch – possible inability to switch signals | Degradation of switch | Loss of 64 signal processors – mission failure | II | III | Provide redundant checks to verify status signal. Interface checks each command sent and echoes command back to DCON to sense this type of failure. |
| 1-76 Closed | IF Switch | Loss of status signal due to software error | Loss of individual status signals | Inability to determine condition of switch | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Provide alert indicating loss of status. |
| 1-77 Closed | IF Switch | Inadvertent status signal due to software error | Incorrect individual status signals | False condition of switch | Possible loss of 64 signal processors | III | III | Provide redundant checks to verify status signal. Status will be updated correctly on next send. |
| 1-78 Closed | IF Switch | Loss of DCON Interface due to connector failure | Inability to control switch | Possible loss of switch | Possible loss of 64 signal processors | III | III | DCON requests status on a periodic basis. Automatic sensing and switchover. |
| 1-79 Closed | IF Switch | Low DCON Interface due to connector failure | Inability to control or redefines switch | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-80 Closed | IF Switch | Noisy DCON Interface due to connector failure | Inability to control or redefines switch | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |
| 1-81 Closed | IF Switch | Inadvertent DCON Interface due to connector failure | Redefine switch operation | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | Invalid Failure Mode |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|---|-------------------------|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-82 Open | IF Switch | Loss of DCON Interface due to software error | Inability to control switch | Possible loss of switch | Possible loss of 64 signal processors | III | III | DCON requests status on a periodic basis. |
| 1-83 Open | IF Switch | Inadvertent DCON Interface due to software error | Redefine switch operation | Loss of switch | Loss of 64 signal processors – mission failure | II | II | Provide feedback on all control commands. Automatic sensing and switchover. |
| 1-84 Closed | IF Switch | Loss of power to IF Switch | Power cannot be supplied to the switch | Loss of switch | Loss of 64 signal processors – mission failure | II | II | DCON requests status on a periodic basis. |
| 1-85 Closed | IF Switch | Low power to IF Switch | Power supplies shut down and power cannot be supplied to the switch | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | No change necessary. DCON will detect low power and provide alert. |
| 1-86 Closed | IF Switch | Noisy power to IF Switch | Power supplies shut down and power cannot be supplied to the switch | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | DCON requests status on a periodic basis. |
| 1-87 Closed | IF Switch | Loss of DC power due to connector failure | Power cannot be supplied to the switch | Loss of switch | Loss of 64 signal processors – mission failure | II | IV | N+1 supplies are provided for each power supply. Status of each supply is sensed and reported in status messages. Power supplies are redundant and hot-swappable. |
| 1-88 Closed | IF Switch | Low DC power due to connector failure | Damage of components on circuit cards – loss of cards | Loss of switch | Loss of 64 signal processors – mission failure | II | IV | N+1 supplies are provided for each power supply. Status of each supply is sensed and reported in status messages. Power supplies are redundant and hot-swappable. |
| 1-89 Closed | IF Switch | Noisy DC power due to connector failure | Damage of components on circuit cards – loss of cards | Loss of switch | Loss of 64 signal processors – mission failure | II | IV | N+1 supplies are provided for each power supply. Status of each supply is sensed and reported in status messages. Power supplies are redundant and hot-swappable. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|-------------------------|--|----------------------|----|---|
| | | | Local | NHA | End | I | F | |
| 1-90 Closed | IF Switch | Loss of DC power due to hardware failure | Power cannot be supplied to the switch | Loss of switch | Loss of 64 signal processors – mission failure | II | IV | N+1 supplies are provided for each power supply. Status of each supply is sensed and reported in status messages. Power supplies are redundant and hot-swappable. |
| 1-91 Closed | IF Switch | Low DC power due to hardware failure | Damage of components on circuit cards – loss of cards | Loss of switch | Loss of 64 signal processors – mission failure | II | IV | N+1 supplies are provided for each power supply. Status of each supply is sensed and reported in status messages. Power supplies are redundant and hot-swappable. |
| 1-92 Closed | IF Switch | Noisy DC power due to hardware failure | Damage of components on circuit cards – loss of cards | Loss of switch | Loss of 64 signal processors – mission failure | II | IV | N+1 supplies are provided for each power supply. Status of each supply is sensed and reported in status messages. Power supplies are redundant and hot-swappable. |
| 1-93 Closed | IF Switch | Loss of fan due to power supply connector failure | Fan shuts down and/or motor burns up | Possible loss of switch | Possible loss of 64 signal processors | III | IV | Fans are integral to power supplies and supply will fail when fan fails with auto failover. |
| 1-94 Closed | IF Switch | Loss of fan due to hardware failure | Fan shuts down | Possible loss of switch | Possible loss of 64 signal processors | III | IV | Fans are integral to power supplies and supply will fail when fan fails with auto failover. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

Appendix 3-E:
DAS Controller (DASCON) Configuration Item
FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|--|-------------------------------|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-1 Closed | DAS Controller | Loss of DAS Ethernet Hub interface due to connector failure | Loss of signal from DAS Ethernet Hub | Loss of DAS control | Loss of Operator Interface Control | IV | IV | DASCON requests timing sync. on a periodic basis. |
| 1-2 Closed | DAS Controller | Low DAS Ethernet Hub interface due to connector failure | Low signal from DAS Ethernet Hub | Loss of DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 1-3 Closed | DAS Controller | Noisy DAS Ethernet Hub interface due to connector failure | Noisy signal from DAS Ethernet Hub | Loss of DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 1-4 Closed | DAS Controller | Inadvertent DAS Ethernet Hub interface due to connector failure | Inadvertent signal from DAS Ethernet Hub | Incorrect DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 1-5 Closed | DAS Controller | Loss of DAS Ethernet Hub interface due to hardware failure | Loss of signal from DAS Ethernet Hub | Loss of DAS control | Loss of Operator Interface Control | IV | IV | DASCON requests timing sync. on a periodic basis. |
| 1-6 Closed | DAS Controller | Low DAS Ethernet Hub interface due to hardware failure | Low signal from DAS Ethernet Hub | Loss of DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 1-7 Closed | DAS Controller | Noisy DAS Ethernet Hub interface due to hardware failure | Noisy signal from DAS Ethernet Hub | Loss of DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 1-8 Closed | DAS Controller | Inadvertent DAS Ethernet Hub interface due to hardware failure | Inadvertent signal from DAS Ethernet Hub | Incorrect DAS control | Incorrect User Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 1-9 Open | DAS Controller | Loss of DAS Ethernet Hub interface due to software error | Loss of signal from DAS Ethernet Hub | Loss of DAS control | Loss of Operator Interface Control | III | III | DAS Controller requests status on a periodic basis. |
| 1-10 Open | DAS Controller | Inadvertent DAS Ethernet Hub interface due to software error | Loss of signal from DAS Ethernet Hub | Loss of DAS control | Loss of Operator Interface Control | II | II | DAS Controller requests status on a periodic basis. |
| 1-11 Closed | DAS Controller | Loss of Frequency Distribution System interface due to connector failure | Inability to control freq. module | Possible loss of freq. module | Possible loss of multiple signal processors | III | NA | No interface; failure mode not possible |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|---|--------------------------------|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-12 Closed | DAS Controller | Low Frequency Distribution System interface due to connector failure | Inability to control or redefines freq. module | Loss of freq. module | Possible loss of multiple signal processors | III | NA | No interface; failure mode not possible |
| 1-13 Closed | DAS Controller | Noisy Frequency Distribution System interface due to connector failure | Inability to control or redefines freq. module | Loss of freq. module | Possible loss of multiple signal processors | III | NA | No interface; failure mode not possible |
| 1-14 Closed | DAS Controller | Inadvertent Frequency Distribution System interface due to connector failure | Redefines operation | Loss of freq. module | Possible loss of multiple signal processors | III | NA | No interface; failure mode not possible |
| 1-15 Closed | DAS Controller | Loss of Frequency Distribution System interface due to software error | Inability to control freq. module | Possible loss of freq. module | Possible loss of multiple signal processors | III | NA | No interface; failure mode not possible |
| 1-16 Closed | DAS Controller | Inadvertent Frequency Distribution System interface due to software error | Redefines operation | Loss of freq. module | Possible loss of multiple signal processors | III | NA | No interface; failure mode not possible |
| 1-17 Closed | DAS Controller | Loss of Frequency Distribution System interface due to hardware failure | Inability to control freq. module | Possible loss of freq. module | Possible loss of multiple signal processors | III | NA | No interface; failure mode not possible |
| 1-18 Closed | DAS Controller | Loss of Time Source interface due to connector failure | Inability to control timing module | Possible loss of timing module | Possible loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 1-19 Closed | DAS Controller | Low Time Source interface due to connector failure | Inability to control or redefines timing module | Loss of timing module | Loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 1-20 Closed | DAS Controller | Noisy Time Source interface due to connector failure | Inability to control or redefines timing module | Loss of timing module | Loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|------------------------------------|--|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-21 Closed | DAS Controller | Inadvertent Time Source interface due to connector failure | Redefines operation | Loss of timing module | Loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 1-22 Closed | DAS Controller | Loss of Time Source interface due to software error | Inability to control timing module | Possible loss of timing module | Possible loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 1-23 Closed | DAS Controller | Inadvertent Time Source interface due to software error | Redefines operation | Loss of timing module | Loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 1-24 Closed | DAS Controller | Loss of Time Source interface due to hardware failure | Inability to control timing module | Possible loss of timing module | Possible loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 1-25 Open | DAS Controller | Loss of User interface due to connector failure | Loss of OS interface | Loss of DAS control | Loss of Operator Interface Control | II | II | User requests status on a periodic basis. |
| 1-26 Closed | DAS Controller | Low User interface due to connector failure | Low OS signal | Loss of DAS control | Loss of Operator Interface Control | II | NA | Digital signal; failure mode not possible. |
| 1-27 Closed | DAS Controller | Noisy User interface due to connector failure | Noisy OS signal | Loss of DAS control | Loss of Operator Interface Control | II | NA | Digital signal; failure mode not possible. |
| 1-28 Closed | DAS Controller | Inadvertent User interface due to connector failure | Inadvertent OS signal | Loss of DAS control | Loss of Operator Interface Control | II | NA | Digital signal; failure mode not possible. |
| 1-29 Open | DAS Controller | Loss of User interface due to hardware failure | Loss of OS interface | Loss of DAS control | Loss of Operator Interface Control | II | II | User requests status on a periodic basis. |
| 1-30 Closed | DAS Controller | Low User interface due to hardware failure | Low OS signal | Loss of DAS control | Loss of Operator Interface Control | II | NA | Digital signal; failure mode not possible. |
| 1-31 Closed | DAS Controller | Noisy User interface due to hardware failure | Noisy OS signal | Loss of DAS control | Loss of Operator Interface Control | II | NA | Digital signal; failure mode not possible. |
| 1-32 Closed | DAS Controller | Inadvertent User interface due to hardware failure | Inadvertent OS signal | Loss of DAS control | Loss of Operator Interface Control | II | NA | Digital signal; failure mode not possible. |
| 1-33 Open | DAS Controller | Loss of User interface due to software error | Loss of OS interface | Loss of DAS control | Loss of Operator Interface Control | II | II | User requests status on a periodic basis. |
| 1-34 Closed | DAS Controller | Inadvertent User interface due to software error | Inadvertent OS signal | Loss of DAS control | Loss of Operator Interface Control | II | NA | User requests status on a periodic basis. |
| 1-35 Open | DAS Controller | Loss of OTSU interface due to connector failure | Loss of component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | III | DAS Controller requests status on a periodic basis. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|---|-------------------------------------|--|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-36 Closed | DAS Controller | Low OTSU interface due to connector failure | Incorrect component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | NA | Digital signal; failure mode not possible. |
| 1-37 Closed | DAS Controller | Noisy OTSU interface due to connector failure | Incorrect component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | NA | Digital signal; failure mode not possible. |
| 1-38 Closed | DAS Controller | Inadvertent OTSU interface due to connector failure | Incorrect component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | NA | Digital signal; failure mode not possible. |
| 1-39 Open | DAS Controller | Loss of OTSU interface due to hardware failure | Loss of component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | III | DAS Controller requests status on a periodic basis. |
| 1-40 Closed | DAS Controller | Low OTSU interface due to hardware failure | Incorrect component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | NA | Digital signal; failure mode not possible. |
| 1-41 Closed | DAS Controller | Noisy OTSU interface due to hardware failure | Incorrect component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | NA | Digital signal; failure mode not possible. |
| 1-42 Closed | DAS Controller | Inadvertent OTSU interface due to hardware failure | Incorrect component/air temperature | Possible loss of some or all of system | Loss of Operator Interface Control | III | NA | Digital signal; failure mode not possible. |
| 1-43 Open | DAS Controller | Loss of OTSU interface due to software error | Loss of component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | III | DAS Controller requests status on a periodic basis. |
| 1-44 Closed | DAS Controller | Inadvertent OTSU interface due to software error | Incorrect component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | NA | Digital signal; failure mode not possible. |
| 1-45 Open | DAS Controller | Loss of controller due to hardware failure | Loss of DAS controller | Inability to control system | Possible loss of all signal processors - Loss of Operator Interface Control | III | III | DAS Controller requests status on a periodic basis. |
| 1-46 Open | DAS Controller | Loss of controller due to software failure | Loss of DAS controller | Inability to control system | Possible loss of all signal processors - Loss of Operator Interface Control | III | III | DAS Controller requests status on a periodic basis. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|------------------------|--|--|-------------------------|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-47 <i>Open</i> | DAS Controller | Loss of fan due to power connector failure | Fan shuts down | Possible loss of DASCON | Possible loss of all signal processors - Loss of Operator Interface Control | III | III | DAS controller monitors fan operation. |
| 1-48 <i>Open</i> | DAS Controller | Loss of fan due to hardware failure | Fan shuts down | Possible loss of DASCON | Possible loss of all signal processors - Loss of Operator Interface Control | III | III | DAS controller monitors fan operation. |
| 1-49 <i>Open</i> | DAS Controller | Loss of input power due to connector failure | Power cannot be supplied to the DASCON | Loss of DASCON | Possible loss of all signal processors - Loss of Operator Interface Control | III | III | OS requests status on a periodic basis. |
| 1-50 <i>Closed</i> | DAS Controller | Low input power due to connector failure | Damage to components in DAS controller | Loss of DAS Controller | Possible loss of all signal processors - Loss of Operator Interface Control | III | IV | DAS Controller requests status on a periodic basis. N+1 power supplies provided |
| 1-51 <i>Closed</i> | DAS Controller | Noisy input power due to connector failure | Damage to components in DAS Controller | Loss of DAS Controller | Possible loss of all signal processors - Loss of Operator Interface Control | III | IV | DAS Controller requests status on a periodic basis. N+1 power supplies provided |
| 1-52 <i>Closed</i> | DAS Controller | Loss of power due to hardware failure | Power cannot be supplied to the DAS Controller | Loss of DAS Controller | Possible loss of all signal processors - Loss of Operator Interface Control | III | IV | User requests status on a periodic basis. DAS Controller monitors power supply operation. N+1 power supplies provided |
| 1-53 <i>Closed</i> | DAS Controller | Low power due to hardware failure | Damage to components in DAS Controller | Loss of DAS Controller | Possible loss of all signal processors - Loss of Operator Interface Control | III | IV | User requests status on a periodic basis. DAS Controller monitors power supply operation. N+1 power supplies provided |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|------------------------|--|--|--|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-54 <i>Closed</i> | DAS Controller | Noisy power due to hardware failure | Damage to components in DAS Controller | Loss of DAS Controller | Possible loss of all signal processors - Loss of Operator Interface Control | III | IV | User requests status on a periodic basis. DAS Controller monitors power supply operation. N+1 power supplies provided |
| 2-1 <i>Open</i> | DASCON Ethernet Hub | Loss of ICON Server interface due to connector failure | Loss of ICON interface | Loss of ICON/IBUG control | Possible loss of 12 signal processors | III | III | DAS Controller requests status on a periodic basis. |
| 2-2 <i>Closed</i> | DASCON Ethernet Hub | Low ICON Server interface due to connector failure | Low ICON interface | Loss of, or inadvertent IBU control | Loss of 12 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-3 <i>Closed</i> | DASCON Ethernet Hub | Noisy ICON Server interface due to connector failure | Noisy ICON interface | Loss of, or inadvertent IBU control | Loss of 12 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-4 <i>Closed</i> | DASCON Ethernet Hub | Inadvertent ICON Server interface due to connector failure | Incorrect ICON interface | Inadvertent IBU control – redefines IBUG | Loss of 12 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-5 <i>Open</i> | DASCON Ethernet Hub | Loss of ICON Server interface due to hardware failure | Loss of ICON interface | Loss of ICON/IBUG control | Possible loss of 12 signal processors | III | III | DAS Controller requests status on a periodic basis. |
| 2-6 <i>Closed</i> | DASCON Ethernet Hub | Low ICON Server interface due to hardware failure | Low ICON interface | Loss of, or inadvertent IBU control | Loss of 12 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-7 <i>Closed</i> | DASCON Ethernet Hub | Noisy ICON Server interface due to hardware failure | Noisy ICON interface | Loss of, or inadvertent IBU control | Loss of 12 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-8 <i>Closed</i> | DASCON Ethernet Hub | Inadvertent ICON Server interface due to hardware failure | Incorrect ICON interface | Inadvertent IBU control – redefines IBUG | Loss of 12 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-9 <i>Open</i> | DASCON Ethernet Hub | Loss of DCON Server interface due to connector failure | Loss of DCON interface | Loss of DCON/DEMOM and IF Switch control | Possible loss of 8 signal processors | III | III | DAS Controller requests status on a periodic basis. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|------------------------------|--|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-10 Closed | DASCON Ethernet Hub | Low DCON Server interface due to connector failure | Low DCON interface | Loss of, or inadvertent DEMOM control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-11 Closed | DASCON Ethernet Hub | Noisy DCON Server interface due to connector failure | Noisy DCON interface | Loss of, or inadvertent DEMOM control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-12 Closed | DASCON Ethernet Hub | Inadvertent DCON Server interface due to connector failure | Incorrect DCON interface | Inadvertent DEMOM control – redefines DEMOM | Loss of 8 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-13 Open | DASCON Ethernet Hub | Loss of DCON Server interface due to hardware failure | Loss of DCON interface | Loss of DCON/ DEMOM and IF Switch control | Loss of 8 signal processors – mission failure | II | II | DAS Controller requests status on a periodic basis. |
| 2-14 Closed | DASCON Ethernet Hub | Low DCON Server interface due to hardware failure | Low DCON interface | Loss of, or inadvertent DEMOM control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-15 Closed | DASCON Ethernet Hub | Noisy DCON Server interface due to hardware failure | Noisy DCON interface | Loss of, or inadvertent DEMOM control | Loss of 8 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-16 Closed | DASCON Ethernet Hub | Inadvertent DCON Server interface due to hardware failure | Incorrect DCON interface | Inadvertent DEMOM control – redefines DEMOM | Loss of 8 signal processors – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-17 Open | DASCON Ethernet Hub | Loss of Archive Server interface due to connector failure | Loss of Archive interface | Loss of Archive Server control via DASCON | Possible loss of message formatting/ archiving | III | III | Provide redundant, periodic interface with Archive Server |
| 2-18 Closed | DASCON Ethernet Hub | Low Archive Server interface due to connector failure | Low Archive interface | Loss of Archive Server control via DASCON | Possible loss of message formatting/ archiving | III | NA | Digital signal; failure mode not possible. |
| 2-19 Closed | DASCON Ethernet Hub | Noisy Archive Server interface due to connector failure | Noisy Archive interface | Loss of Archive Server control via DASCON | Possible loss of message formatting/ archiving | III | NA | Digital signal; failure mode not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|---|--------------------------------|--|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-20 Closed | DASCON Ethernet Hub | Inadvertent Archive Server interface due to connector failure | Incorrect Archive interface | Incorrect Archive Server control via DASCON | Possible incorrect message formatting/ archiving | III | NA | Digital signal; failure mode not possible. |
| 2-21 Open | DASCON Ethernet Hub | Loss of Archive Server interface due to hardware failure | Loss of Archive interface | Loss of Archive Server control via DASCON | Possible loss of message formatting/ archiving | III | III | Provide redundant, periodic interface with Archive Server |
| 2-22 Closed | DASCON Ethernet Hub | Low Archive Server interface due to hardware failure | Low Archive interface | Loss of Archive Server control via DASCON | Possible loss of message formatting/ archiving | III | NA | Digital signal; failure mode not possible. |
| 2-23 Closed | DASCON Ethernet Hub | Noisy Archive Server interface due to hardware failure | Noisy Archive interface | Loss of Archive Server control via DASCON | Possible loss of message formatting/ archiving | III | NA | Digital signal; failure mode not possible. |
| 2-24 Closed | DASCON Ethernet Hub | Inadvertent Archive Server interface due to hardware failure | Incorrect Archive interface | Incorrect Archive Server control via DASCON | Possible incorrect message formatting/ archiving | III | NA | Digital signal; failure mode not possible. |
| 2-25 Open | DASCON Ethernet Hub | Loss of ECON interface due to connector failure | Loss of ECON interface | Loss of TDRS operational status and state vectors | Reduction of Beamforming accuracy | III | III | DAS Controller requests status on a periodic basis. |
| 2-26 Closed | DASCON Ethernet Hub | Low ECON interface due to connector failure | Low ECON interface | Incorrect TDRS operational status and state vectors | Inaccurate Beamforming | II | NA | Digital signal; failure mode not possible. |
| 2-27 Closed | DASCON Ethernet Hub | Noisy ECON interface due to connector failure | Noisy ECON interface | Incorrect TDRS operational status and state vectors | Inaccurate Beamforming | II | NA | Digital signal; failure mode not possible. |
| 2-28 Closed | DASCON Ethernet Hub | Inadvertent ECON interface due to connector failure | Incorrect ECON interface | Incorrect TDRS operational status and state vectors | Inaccurate Beamforming | II | NA | Digital signal; failure mode not possible. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|------------------------|---|-----------------------------|--|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-29 <i>Open</i> | DASCON Ethernet Hub | Loss of ECON interface due to hardware failure | Loss of ECON interface | Loss of TDRS operational status and state vectors | Reduction of Beamforming accuracy | III | III | DAS Controller requests status on a periodic basis. |
| 2-30 <i>Closed</i> | DASCON Ethernet Hub | Low ECON interface due to hardware failure | Low ECON interface | Low TDRS operational status and state vectors | Inaccurate Beamforming | II | NA | Digital signal; failure mode not possible. |
| 2-31 <i>Closed</i> | DASCON Ethernet Hub | Noisy ECON interface due to hardware failure | Noisy ECON interface | Noisy TDRS operational status and state vectors | Inaccurate Beamforming | II | NA | Digital signal; failure mode not possible. |
| 2-32 <i>Closed</i> | DASCON Ethernet Hub | Inadvertent ECON interface due to hardware failure | Incorrect ECON interface | Incorrect TDRS operational status and state vectors | Inaccurate Beamforming | II | NA | Digital signal; failure mode not possible. |
| 2-33 <i>Open</i> | DASCON Ethernet Hub | Loss of GRGT interface due to connector failure | Loss of GRGT interface | Loss of GRGT status, control, and new service setup | Inability to process new services | III | III | DAS Controller requests status on a periodic basis. |
| 2-34 <i>Closed</i> | DASCON Ethernet Hub | Low GRGT interface due to connector failure | Low GRGT interface | Incorrect GRGT status, control, and new service setup | Incorrect processing of new services | II | NA | Digital signal; failure mode not possible. |
| 2-35 <i>Closed</i> | DASCON Ethernet Hub | Noisy GRGT interface due to connector failure | Noisy GRGT interface | Incorrect GRGT status, control, and new service setup | Incorrect processing of new services | II | NA | Digital signal; failure mode not possible. |
| 2-36 <i>Closed</i> | DASCON Ethernet Hub | Inadvertent GRGT interface due to connector failure | Incorrect GRGT interface | Incorrect GRGT status, control, and new service setup | Incorrect processing of new services | II | NA | Digital signal; failure mode not possible. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|------------------------|---|--|--|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-37 <i>Open</i> | DASCON Ethernet Hub | Loss of GRGT interface due to hardware failure | Loss of GRGT interface | Loss of GRGT status, control, and new service setup | Inability to process new services | III | III | DAS Controller requests status on a periodic basis. |
| 2-38 <i>Closed</i> | DASCON Ethernet Hub | Low GRGT interface due to hardware failure | Low GRGT interface | Incorrect GRGT status, control, and new service setup | Incorrect processing of new services | II | NA | Digital signal; failure mode not possible. |
| 2-39 <i>Closed</i> | DASCON Ethernet Hub | Noisy GRGT interface due to hardware failure | Noisy GRGT interface | Incorrect GRGT status, control, and new service setup | Incorrect processing of new services | II | NA | Digital signal; failure mode not possible. |
| 2-40 <i>Closed</i> | DASCON Ethernet Hub | Inadvertent GRGT interface due to hardware failure | Incorrect GRGT interface | Incorrect GRGT status, control, and new service setup | Incorrect processing of new services | II | NA | Digital signal; failure mode not possible. |
| 2-41 <i>Closed</i> | DASCON Ethernet Hub | Loss of DAS Controller interface due to connector failure | Loss of signal from DAS Controller | Loss of DAS control | Loss of Operator Interface Control | IV | IV | DASCON requests timing sync. on a periodic basis. |
| 2-42 <i>Closed</i> | DASCON Ethernet Hub | Low DAS Controller interface due to connector failure | Low signal from DAS Controller | Loss of DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 2-43 <i>Closed</i> | DASCON Ethernet Hub | Noisy DAS Controller interface due to connector failure | Noisy signal from DAS Controller | Loss of DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 2-44 <i>Closed</i> | DASCON Ethernet Hub | Inadvertent DAS Controller interface due to connector failure | Inadvertent signal from DAS Controller | Incorrect DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 2-45 <i>Closed</i> | DASCON Ethernet Hub | Loss of DAS Controller interface due to hardware failure | Loss of signal from DAS Controller | Loss of DAS control | Loss of Operator Interface Control | IV | IV | DASCON requests timing sync. on a periodic basis. |
| 2-46 <i>Closed</i> | DASCON Ethernet Hub | Low DAS Controller interface due to hardware failure | Low signal from DAS Controller | Loss of DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|--|--------------------------|---------------------------------------|----------------------|----|---|
| | | | Local | NHA | End | I | F | |
| 2-47 Closed | DASCON Ethernet Hub | Noisy DAS Controller interface due to hardware failure | Noisy signal from DAS Controller | Loss of DAS control | Loss of Operator Interface Control | IV | NA | Digital signal; failure mode not possible. |
| 2-48 Closed | DASCON Ethernet Hub | Inadvertent DAS Controller interface due to hardware failure | Inadvertent signal from DAS Controller | Incorrect DAS control | Incorrect User Interface Control | IV | NA | Digital signal; failure mode not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

Appendix 3-F:
Demodulator Controller (DCON) Configuration Item
FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|---------------------------|--|---|--|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-1 Closed | DCON Server | Loss of DCON Ethernet Hub interface due to connector failure | Loss of DCON Ethernet Hub interface | Loss of DCON/ DMG control | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 1-2 Closed | DCON Server | Low DCON Ethernet Hub interface due to connector failure | Low DCON Ethernet Hub interface | Loss of, or inadvertent DMU control | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-3 Closed | DCON Server | Noisy DCON Ethernet Hub interface due to connector failure | Noisy DCON Ethernet Hub interface | Loss of, or inadvertent DMU control | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-4 Closed | DCON Server | Inadvertent DCON Ethernet Hub interface due to connector failure | Incorrect DCON Ethernet Hub interface | Inadvertent DCON control – redefines DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-5 Closed | DCON Server | Loss of DCON Ethernet Hub interface due to hardware failure | Loss of DCON Ethernet Hub interface | Loss of DCON/ DMG control | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 1-6 Closed | DCON Server | Low DCON Ethernet Hub interface due to hardware failure | Low DCON Ethernet Hub interface | Loss of, or inadvertent DMU control | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-7 Closed | DCON Server | Noisy DCON Ethernet Hub interface due to hardware failure | Noisy DCON Ethernet Hub interface | Loss of, or inadvertent DMU control | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-8 Closed | DCON Server | Inadvertent DCON Ethernet Hub interface due to hardware failure | Incorrect DCON Ethernet Hub interface | Inadvertent DCON control – redefines DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-9 Open | DCON Server | Loss of control signal due to software error | Possible inability to control DMG interface signals | Possible degradation of DMG Interface | Possible loss of all signal processors | III | III | Provide monitoring/ feedback for all control commands. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|-----------------------------------|---|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-10 Open | DCON Server | Inadvertent control signal due to software error | Redefines DMG Interface operation | Degradation of DMG Interface | Loss of all signal processors – mission failure | II | II | Provide monitoring/ feedback for all control commands. |
| 1-11 Closed | DCON Server | Loss of status signal due to software error | Loss of DMG Interface status | Inability to determine condition of DMG Interface | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | DCON Server requests status on a periodic basis. |
| 1-12 Open | DCON Server | Inadvertent status signal due to software error | Incorrect status of DMG Interface | False condition of DMG Interface | Possible loss of two signal processors | III | III | Provide redundant checks to verify status signal |
| 1-13 Closed | DCON Server | Loss of DASCON Ethernet Hub interface due to connector failure | Loss of DASCON interface | Loss of DCON/DMG control | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 1-14 Closed | DCON Server | Low DASCON Ethernet Hub interface due to connector failure | Low DASCON interface | Loss of, or inadvertent DMU control | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-15 Closed | DCON Server | Noisy DASCON Ethernet Hub interface due to connector failure | Noisy DASCON interface | Loss of, or inadvertent DMU control | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-16 Closed | DCON Server | Inadvertent DASCON Ethernet Hub interface due to connector failure | Incorrect DASCON interface | Inadvertent DCON control – redefines DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-17 Closed | DCON Server | Loss of DASCON Ethernet Hub interface due to hardware failure | Loss of DASCON interface | Loss of DCON/DMG control | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 1-18 Closed | DCON Server | Low DASCON Ethernet Hub interface due to hardware failure | Low DASCON interface | Loss of, or inadvertent DMU control | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|--|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-19 Closed | DCON Server | Noisy DASCON Ethernet Hub interface due to hardware failure | Noisy DASCON interface | Loss of, or inadvertent DMU control | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-20 Closed | DCON Server | Inadvertent DASCON Ethernet Hub interface due to hardware failure | Incorrect DASCON interface | Inadvertent DCON control – redefines DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-21 Closed | DCON Server | Loss of Time source input due to connector failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp capability | III | IV | Internal clock in DCON is capable of providing time stamp for limited time. Monitoring and alert provided. |
| 1-22 Closed | DCON Server | Loss of Time source input due to hardware failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp capability | III | IV | Internal clock in DASCON is capable of providing time stamp for limited time. Monitoring and alert provided. |
| 1-23 Closed | DCON Server | Loss of IF Switch Interface due to connector failure | Inability to control switch | Possible loss of switch | Possible loss of ten signal processors | III | III | DCON requests status on a periodic basis |
| 1-24 Closed | DCON Server | Low IF Switch Interface due to connector failure | Inability to control or redefines switch | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-25 Closed | DCON Server | Noisy IF Switch Interface due to connector failure | Inability to control or redefines switch | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-26 Closed | DCON Server | Inadvertent IF Switch Interface due to connector failure | Redefine switch operation | Loss of switch | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 1-27 Open | DCON Server | Loss of IF Switch Interface due to software error | Inability to control switch | Possible loss of switch | Possible loss of 10 signal processors | III | III | DCON requests status on a periodic basis |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|------------------------------|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-28 Open | DCON Server | Inadvertent IF Switch Interface due to software error | Redefine switch operation | Loss of switch | Loss of 10 signal processors – mission failure | II | II | Provide feedback on all control commands. |
| 1-29 Open | DCON Server | Loss of fan due to power connector failure | Fan shuts down | Possible loss of DCON Server | Possible loss of all signal processors - Loss of Operator Interface Control. | III | III | DCON Server monitors fan operation. |
| 1-30 Open | DCON Server | Loss of fan due to hardware failure | Fan shuts down | Possible loss of DCON Server | Possible loss of all signal processors -Loss of Operator Interface Control | III | III | DCON Server monitors fan operation. |
| 1-31 Closed | DCON Server | Loss of input power due to connector failure | Power cannot be supplied to the DCON Server | Loss of DCON Server | Possible loss of all signal processors -Loss of Operator Interface Control | III | IV | DCON server monitors power supply operation. N+1 power supplies provided. |
| 1-32 Closed | DCON Server | Low input power due to connector failure | Damage to components in DCON Server | Loss of DCON Server | Possible loss of all signal processors -Loss of Operator Interface Control | III | IV | DCON server monitors power supply operation. N+1 power supplies provided. |
| 1-33 Closed | DCON Server | Noisy input power due to connector failure | Damage to components in DCON Server | Loss of DCON Server | Possible loss of all signal processors -Loss of Operator Interface Control | III | IV | DCON server monitors power supply operation. N+1 power supplies provided. |
| 1-34 Closed | DCON Server | Loss of power due to hardware failure | Power cannot be supplied to the DCON Server | Loss of DCON Server | Possible loss of all signal processors -Loss of Operator Interface Control | III | IV | DCON Server monitors power supply operation. N+1 power supplies provided |
| 1-35 Closed | DCON Server | Low power due to hardware failure | Damage to components in DCON Server | Loss of DCON Server | Possible loss of all signal processors -Loss of Operator Interface Control | III | IV | DCON Server monitors power supply operation. N+1 power supplies provided |
| 1-36 Closed | DCON Server | Noisy power due to hardware failure | Damage to components in DCON Server | Loss of DCON Server | Possible loss of all signal processors -Loss of Operator Interface Control | III | IV | DCON Server monitors power supply operation. N+1 power supplies provided |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|---------------------------|--|---|--|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-1 Closed | DCON Ethernet Hub | Loss of DMG interface due to connector failure | Inability to control DMG | Possible loss of entire DMG | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 2-2 Closed | DCON Ethernet Hub | Low DMG interface due to connector failure | Inability to control or redefines DMG | Loss of entire DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-3 Closed | DCON Ethernet Hub | Noisy DMG interface due to connector failure | Inability to control or redefines DMG | Loss of entire DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-4 Closed | DCON Ethernet Hub | Inadvertent DMG interface due to connector failure | Redefines operation | Loss of entire DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-5 Closed | DCON Ethernet Hub | Loss of DMG interface due to hardware failure | Loss of DMG control signal | Inability to control DMG | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 2-6 Closed | DCON Ethernet Hub | Low DMG interface due to hardware failure | Low DMG control signal | Inability to control DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-7 Closed | DCON Ethernet Hub | Noisy DMG interface due to hardware failure | Noisy DMG control signal | Inability to control or redefines DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-8 Closed | DCON Ethernet Hub | Inadvertent DMG interface due to hardware failure | Inadvertent DMG control signal | Redefines DMG | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-9 Open | DCON Ethernet Hub | Loss of DMG interface due to software error | Inability to control DMU | Possible loss of entire DMG | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 2-10 Open | DCON Ethernet Hub | Inadvertent DMG interface due to software error | Redefines operation | Loss of entire DMG | Loss of 10 signal processors – mission failure | II | II | DCON Server requests status on a periodic basis. |
| 2-11 Open | DCON Ethernet Hub | Loss of control signal due to software error | Possible inability to control EMC interface signals | Possible degradation of EMC Interface | Possible loss of all signal processors | III | III | DCON Server requests status on a periodic basis. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|--|--|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-12 Open | DCON Ethernet Hub | Inadvertent control signal due to software error | Redefines EMC Interface operation | Degradation of EMC Interface | Loss of all signal processors – mission failure | II | II | Provide monitoring/ feedback for all control commands. |
| 2-13 Closed | DCON Ethernet Hub | Loss of status signal due to software error | Loss of EMC Interface status | Inability to determine condition of EMC Interface | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | DCON Server requests status on a periodic basis. |
| 2-14 Open | DCON Ethernet Hub | Inadvertent status signal due to software error | Incorrect status of EMC Interface | False condition of EMC Interface | Possible loss of two signal processors | III | III | DCON Server requests status on a periodic basis. |
| 2-15 Closed | DCON Ethernet Hub | Loss of DCON Server interface due to connector failure | Loss of DCON Server interface | Inability to control DCON Server, inability to receive message | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 2-16 Closed | ION Ethernet Hub | Low DCON Server interface due to connector failure | Low DCON Server control signal | Inability to control or redefines DCON Server | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-17 Closed | DCON Ethernet Hub | Noisy DCON Server interface due to connector failure | Noisy DCON Server control signal | Inability to control or redefines DCON Server | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-18 Closed | DCON Ethernet Hub | Inadvertent DCON Server interface due to connector failure | Inadvertent DCON Server control signal | Redefines DCON Server | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-19 Closed | DCON Ethernet Hub | Loss of DCON Server interface due to hardware failure | Loss of DCON Server interface | Inability to control DCON Server, inability to receive message | Possible loss of 10 signal processors | III | III | DCON Server requests status on a periodic basis. |
| 2-20 Closed | DCON Ethernet Hub | Low DCON Server interface due to hardware failure | Low DCON Server control signal | Inability to control or redefines DCON Server | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-21 Closed | DCON Ethernet Hub | Noisy DCON Server interface due to hardware failure | Noisy DCON Server control signal | Inability to control or redefines DCON Server | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |
| 2-22 Closed | DCON Ethernet Hub | Inadvertent DCON Server interface due to hardware failure | Inadvertent DCON Server control signal | Redefines DCON Server | Loss of 10 signal processors – mission failure | II | NA | Digital signal; not possible |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

Appendix 3-G:
Frequency and Timing Configuration Item
FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|-------------------------------------|--|--------------------------------|---|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-1 Open | Frequency Distribution System | Loss of inputs due to site failure | Loss of external freq. ref. | Loss of freq. module | Loss of multiple demodulator groups. | II | II | Provide internal oscillator in DRU which is capable of sustaining operation for limited time. |
| 1-2 Open | Frequency Distribution System | Low inputs due to site failure | Low external freq. ref. | Possible degradation of freq. module | Possible loss of multiple demodulator groups. | III | III | Provide internal oscillator in DRU which is capable of sustaining operation for limited time. |
| 1-3 Open | Frequency Distribution System | Noisy inputs due to site failure | Noisy external freq. ref. | Possible degradation of freq. module | Possible loss of multiple demodulator groups. | III | III | Provide internal oscillator in DRU which is capable of sustaining operation for limited time. |
| 1-4 Closed | Frequency Distribution System | Loss of primary input reference due to connector failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-5 Closed | Frequency Distribution System | Low primary input reference due to connector failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-6 Closed | Frequency Distribution System | Noisy primary input reference due to connector failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-7 Closed | Frequency Distribution System | Loss of primary input reference due to interface failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-8 Closed | Frequency Distribution System | Low primary input reference due to interface failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-9 Closed | Frequency Distribution System | Noisy primary input reference due to interface failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-10 Closed | Frequency Distribution System | Loss of secondary input reference due to connector failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|-------------------------------------|--|---|---|---|----------------------|-----|-------------------------------|
| | | | Local | NHA | End | I | F | |
| 1-11 Closed | Frequency Distribution System | Low secondary input reference due to connector failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-12 Closed | Frequency Distribution System | Noisy secondary input reference due to connector failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-13 Closed | Frequency Distribution System | Loss of secondary input reference due to interface failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-14 Closed | Frequency Distribution System | Low secondary input reference due to interface failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-15 Closed | Frequency Distribution System | Noisy secondary input reference due to interface failure | No effect | No effect | No effect | IV | IV | Secondary backup is provided. |
| 1-16 Closed | Frequency Distribution System | Loss of signal output due to connector failure | Loss of freq. ref. to signal processor | Possible degradation of freq. module | Loss of one demodulator group. | II | II | Sensed and reported by DMG. |
| 1-17 Closed | Frequency Distribution System | Low signal output due to connector failure | Low freq. ref. to signal processor | Possible degradation of freq. module | Possible loss of one demodulator group. | III | III | Sensed and reported by DMG. |
| 1-18 Closed | Frequency Distribution System | Noisy signal output due to connector failure | Noisy freq. ref. to signal processor | Possible degradation of freq. module | Possible loss of one demodulator group. | III | III | Sensed and reported by DMG. |
| 1-19 Closed | Frequency Distribution System | Loss of signal output due to hardware failure | Loss of freq. ref. to signal processor | Possible degradation of freq. module | Loss of one DMG. | II | II | Sensed and reported by DMG. |
| 1-20 Closed | Frequency Distribution System | Low signal output due to hardware failure | Low freq. ref. to signal processor | Possible degradation of freq. module | Possible loss of one demodulator group. | III | III | Sensed and reported by DMG. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|-------------------------------------|---|--|---|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-21 <i>Closed</i> | Frequency Distribution System | Noisy signal output due to hardware failure | Noisy freq. ref. to signal processor | Possible degradation of freq. module | Possible loss of one demodulator group. | III | III | Sensed and reported by DMG. |
| 1-22 <i>Closed</i> | Frequency Distribution System | Loss of all outputs due to hardware failure | Loss of freq. ref. to all signal processor | Possible degradation of freq. module | Loss of all demodulator groups. | II | II | Sensed and reported by DMG |
| 1-23 <i>Closed</i> | Frequency Distribution System | All outputs low due to hardware failure | Low freq. ref. to all signal processor | Possible degradation of freq. module | Possible loss of all demodulator groups. | III | III | Sensed and reported by DMG |
| 1-24 <i>Closed</i> | Frequency Distribution System | All outputs noisy due to hardware failure | Noisy freq. ref. to all signal processor | Possible degradation of freq. module | Possible loss of all demodulator groups. | III | III | Sensed and reported by DMG |
| 1-25 <i>Closed</i> | Frequency Distribution System | Loss of DASCON interface due to connector failure | Inability to control freq. module | Possible loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | No DASCON interface. Failure not possible. |
| 1-26 <i>Closed</i> | Frequency Distribution System | Low DASCON interface due to connector failure | Inability to control or redefines freq. module | Loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | No DASCON interface. Failure not possible. |
| 1-27 <i>Closed</i> | Frequency Distribution System | Noisy DASCON interface due to connector failure | Inability to control or redefines freq. module | Loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | No DASCON interface. Failure not possible. |
| 1-28 <i>Closed</i> | Frequency Distribution System | Inadvertent DASCON interface due to connector failure | Redefines operation | Loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | No DASCON interface. Failure not possible. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|-------------------------------------|--|--|-------------------------------------|--|----------------------|----|---|
| | | | Local | NHA | End | I | F | |
| 1-29 Closed | Frequency Distribution System | Loss of DASCON interface due to software error | Inability to control freq. module | Possible loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | No DASCON interface. Failure not possible. |
| 1-30 Closed | Frequency Distribution System | Inadvertent DASCON interface due to software error | Redefines operation | Loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | No DASCON interface. Failure not possible. |
| 1-31 Closed | Frequency Distribution System | Loss of DASCON interface due to hardware failure | Inability to control freq. module | Possible loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | No DASCON interface. Failure not possible. |
| 1-32 Closed | Frequency Distribution System | Loss of supply power to freq. module | Power cannot be supplied to the freq. module | Loss of freq. module | Loss of multiple demodulator groups. | II | II | Sensed and reported by DMG |
| 1-33 Closed | Frequency Distribution System | Low supply power to freq. module | Internal power supplies shut down | Loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | Failure not possible with AC power. |
| 1-34 Closed | Frequency Distribution System | Noisy supply power to freq. module | Internal power supplies shut down | Loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | Failure not possible with AC power. |
| 1-35 Close | Frequency Distribution System | Loss of power due to connector failure | Power cannot be supplied to the freq. module | Loss of freq. module | Loss of multiple demodulator groups. | II | NA | Failure not possible with AC power. |
| 1-36 Closed | Frequency Distribution System | Low power due to connector failure | Internal power supplies shut down | Loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | Failure not possible with AC power. |
| 1-37 Closed | Frequency Distribution System | Noisy power due to connector failure | Internal power supplies shut down | Loss of freq. module | Possible loss of multiple demodulator groups. | III | NA | Failure not possible with AC power. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|---------------------------|--|------------------------------------|---------------------------------------|---------------------------------------|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-1 Closed | Time Source | Loss of inputs due to site failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp accuracy. | III | III | Failure is monitored and reported. Time stamp will continue unabated, but with less accuracy until device is repaired. |
| 2-2 Closed | Time Source | Low inputs due to site failure | Low external timing ref. | Possible degradation of timing module | Possible loss of time stamp accuracy. | III | NA | Digital signal; not possible. |
| 2-3 Closed | Time Source | Noisy inputs due to site failure | Noisy external timing ref. | Possible degradation of timing module | Possible loss of time stamp accuracy. | III | NA | Digital signal; not possible. |
| 2-4 Closed | Time Source | Loss of input source due to connector failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp accuracy. | III | III | Failure is monitored and reported. Time stamp will continue unabated, but with less accuracy until device is repaired. |
| 2-5 Closed | Time Source | Low input source due to connector failure | Low external timing ref. | Possible degradation of timing module | Possible loss of time stamp accuracy. | III | NA | Digital signal; not possible. |
| 2-6 Closed | Time Source | Noisy input source due to connector failure | Noisy external timing ref. | Possible degradation of timing module | Possible loss of time stamp accuracy. | III | NA | Digital signal; not possible. |
| 2-7 Closed | Time Source | Loss of output to DCON/ICON/ Archive Server due to connector failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp accuracy. | III | III | Failure is monitored and reported. Time stamp will continue unabated, but with less accuracy until device is repaired |
| 2-8 Closed | Time Source | Loss of output to DCON/ICON/ Archive Server due to hardware failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp accuracy. | III | III | Failure is monitored and reported. Time stamp will continue unabated, but with less accuracy until device is repaired |
| 2-9 Closed | Time Source | Loss of DASCON interface due to connector failure | Inability to control timing module | Possible loss of timing module | Possible loss of time stamp accuracy. | III | III | Loss of signal is sensed by controllers and reported. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|--------------------------------|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-10 Closed | Time Source | Low DASCON interface due to connector failure | Inability to control or redefines timing module | Loss of timing module | Loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 2-11 Closed | Time Source | Noisy DASCON interface due to connector failure | Inability to control or redefines timing module | Loss of timing module | Loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 2-12 Closed | Time Source | Inadvertent DASCON interface due to connector failure | Redefines operation | Loss of timing module | Loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 2-13 Closed | Time Source | Loss of DASCON interface due to software error | Inability to control timing module | Possible loss of timing module | Possible loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 2-14 Closed | Time Source | Inadvertent DASCON interface due to software error | Redefines operation | Loss of timing module | Loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 2-15 Closed | Time Source | Loss of DASCON interface due to hardware failure | Inability to control timing module | Possible loss of timing module | Possible loss of time stamp capability | III | III | Loss of signal is sensed by controllers and reported. |
| 2-16 Closed | Time Source | Loss of supply power to timing module | Power cannot be supplied to the timing module | Loss of timing module | Possible loss of time stamp accuracy. | III | III | Site requests timing synchronization on a periodic basis. Time stamp will continue unabated, but with less accuracy until device is repaired |
| 2-17 Closed | Time Source | Low supply power to timing module | Internal power supplies shut down | Loss of timing module | Possible loss of time stamp accuracy. | III | NA | Digital signal; not possible. |
| 2-18 Closed | Time Source | Noisy supply power to timing module | Internal power supplies shut down | Loss of timing module | Possible loss of time stamp accuracy. | III | NA | Digital signal; not possible. |
| 2-19 Closed | Time Source | Loss of power due to connector failure | Power cannot be supplied to the timing module | Loss of timing module | Possible loss of time stamp accuracy. | III | III | Site requests timing synchronization on a periodic basis. Time stamp will continue unabated, but with less accuracy until device is repaired |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|-----------------------------|---|----------------------|----|-------------------------------|
| | | | Local | NHA | End | I | F | |
| 2-20 Closed | Time Source | Low power due to connector failure | Internal power supplies shut down | Loss of timing module | Possible loss of time stamp accuracy. | III | NA | Digital signal; not possible. |
| 2-21 Closed | Time Source | Noisy power due to connector failure | Internal power supplies shut down | Loss of timing module | Possible loss of time stamp accuracy. | III | NA | Digital signal; not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

Appendix 3-H:
Mechanical and Power Configuration Item
FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|-------------------------------|---|---|--|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-1 Open | Over Temperature Sensor | Loss of temperature sensor signal due to connector failure | Inability to determine component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | IV | Temperature failure will flag an alert. There will be no DAS loss unless a valid over-temp condition occurs, in which case the operator will determine shutdown criteria. N+1 sensors are present and open racks will show gradual rises in temperature. |
| 1-2 Open | Over Temperature Sensor | Low temperature sensor signal due to connector failure | Inability to determine component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | IV | Temperature failure will flag an alert. There will be no DAS loss unless a valid over-temp condition occurs, in which case the operator will determine shutdown criteria. N+1 sensors are present and open racks will show gradual rises in temperature. |
| 1-3 Open | Over Temperature Sensor | Noisy temperature sensor signal due to connector failure | Inability to determine component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | IV | Temperature failure will flag an alert. There will be no DAS loss unless a valid over-temp condition occurs, in which case the operator will determine shutdown criteria. N+1 sensors are present and open racks will show gradual rises in temperature. |
| 1-4 Open | Over Temperature Sensor | Inadvertent temperature sensor signal due to connector failure | Incorrect component/air temperature | Loss of some or all of system | Loss of some or all signal processors | II | III | Temperature failure will flag an alert. There will be no DAS loss unless a valid over-temp condition occurs, in which case the operator will determine shutdown criteria. N+1 sensors are present and open racks will show gradual rises in temperature. |
| 1-5 Open | Over Temperature Sensor | Loss of temperature sensor signal due to hardware failure | Inability to determine component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | IV | Temperature failure will flag an alert. There will be no DAS loss unless a valid over-temp condition occurs, in which case the operator will determine shutdown criteria. N+1 sensors are present and open racks will show gradual rises in temperature. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|-------------------------------|--|--|---|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-6 Open | Over Temperature Sensor | Low temperature sensor signal due to hardware failure | Inability to determine component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | IV | Temperature failure will flag an alert. There will be no DAS loss unless a valid over-temp condition occurs; operator will determine shutdown criteria. N+1 sensors are present and open racks will show gradual rises in temperature. |
| 1-7 Open | Over Temperature Sensor | Noisy temperature sensor signal due to hardware failure | Inability to determine component/air temperature | Possible loss of some or all of system | Possible loss of some or all signal processors | III | IV | Temperature failure will flag an alert. There will be no DAS loss unless a valid over-temp condition occurs; operator will determine shutdown criteria. N+1 sensors are present and open racks will show gradual rises in temperature. |
| 1-8 Open | Over Temperature Sensor | Inadvertent temperature sensor signal due to hardware failure | Incorrect component/air temperature | Loss of some or all of system | Loss of some or all signal processors | II | IV | Temperature failure will flag an alert. There will be no DAS loss unless a valid over-temp condition occurs; operator will determine shutdown criteria. N+1 sensors are present and open racks will show gradual rises in temperature. |
| 1-9 Open | Over Temperature Sensor | Connector and hardware failures between temperature monitor and DCON. | Inability to determine component/air temperature. | Loss of ability to measure temperature. | Possible loss of ability to sense over-temp condition. | III | III | Temperature status is queried and monitored regularly by DCON. Signal loss will trigger alert. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

Appendix 3-I:

Data Formatter/Archive Server Configuration Item

FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|------------------------|--|---|---|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-1 Closed | Archive Server | Loss of DASCON Ethernet Hub interface due to connector failure | Loss of signal from DASCON Ethernet Hub | Loss of Archive Server control via DASCON | Possible loss of message formatting/archiving | III | III | DASCON Server requests status on a periodic basis. |
| 1-2 Closed | Archive Server | Low DASCON Ethernet Hub interface due to connector failure | Low signal from DASCON Ethernet Hub | Loss of Archive Server control via DASCON | Possible loss of message formatting/archiving | III | NA | Digital signal; failure mode not possible. |
| 1-3 Closed | Archive Server | Noisy DASCON Ethernet Hub interface due to connector failure | Noisy signal from DASCON Ethernet Hub | Loss of Archive Server control via DASCON | Possible loss of message formatting/archiving | III | NA | Digital signal; failure mode not possible. |
| 1-4 Closed | Archive Server | Inadvertent DASCON Ethernet Hub interface due to connector failure | Inadvertent signal from DASCON Ethernet Hub | Incorrect Archive Server control via DASCON | Possible incorrect message formatting/archiving | III | NA | Digital signal; failure mode not possible. |
| 1-5 Closed | Archive Server | Loss of DASCON Ethernet Hub interface due to hardware failure | Loss of signal from DASCON Ethernet Hub | Loss of Archive Server control via DASCON | Possible loss of message formatting/archiving | III | III | DASCON Server requests status on a periodic basis. |
| 1-6 Closed | Archive Server | Low DASCON Ethernet Hub interface due to hardware failure | Low signal from DASCON Ethernet Hub | Loss of Archive Server control via DASCON | Possible loss of message formatting/archiving | III | NA | Digital signal; failure mode not possible. |
| 1-7 Closed | Archive Server | Noisy DASCON Ethernet Hub interface due to hardware failure | Noisy signal from DASCON Ethernet Hub | Loss of Archive Server control via DASCON | Possible loss of message formatting/archiving | III | NA | Digital signal; failure mode not possible. |
| 1-8 Closed | Archive Server | Inadvertent DASCON Ethernet Hub interface due to hardware failure | Inadvertent signal from DASCON Ethernet Hub | Incorrect Archive Server control via DASCON | Possible incorrect message formatting/archiving | III | NA | Digital signal; failure mode not possible. |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|--|--|--|--------------------------------------|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-9 Closed | Archive Server | Loss of Archive Ethernet Switch interface due to connector failure | Loss of signal from Archive Ethernet Switch | Inability to receive DMG signal | Loss of DMG signal | II | II | Archive Server requests status on a periodic basis. |
| 1-10 Closed | Archive Server | Low Archive Ethernet Switch interface due to connector failure | Low signal from Archive Ethernet Switch | Inability to receive DMG signal | Loss of DMG signal | II | NA | Digital signal; failure mode not possible. |
| 1-11 Closed | Archive Server | Noisy Archive Ethernet Switch interface due to connector failure | Noisy signal from Archive Ethernet Switch | Inability to receive DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-12 Closed | Archive Server | Inadvertent Archive Ethernet Switch interface due to connector failure | Inadvertent signal from Archive Ethernet Switch | Incorrect DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-13 Closed | Archive Server | Loss of Archive Ethernet Switch interface due to hardware failure | Loss of signal from Archive Ethernet Switch | Inability to receive DMG signal | Possible loss of DMG signal | III | III | Archive Server requests status on a periodic basis. |
| 1-14 Closed | Archive Server | Low Archive Ethernet Switch interface due to hardware failure | Low signal from Archive Ethernet Switch | Inability to receive DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-15 Closed | Archive Server | Noisy Archive Ethernet Switch interface due to hardware failure | Noisy signal from Archive Ethernet Switch | Inability to receive DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-16 Closed | Archive Server | Inadvertent Archive Ethernet Switch interface due to hardware failure | Inadvertent signal from Archive Ethernet Switch | Incorrect DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-17 Open | Archive Server | Loss of Archive Ethernet Switch interface due to software error | Loss of IBUG, Archive Server and Time Source interface | Inability to control IBUG, Archive Server and Time Source, inability to received message | Possible loss of DMG signal | III | III | Archive Server requests status on a periodic basis. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|---|---|--|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-18 Closed | Archive Server | Inadvertent Archive Ethernet Switch interface due to software error | Inadvertent IBUG, Archive Server and Time Source control signal | Redefines IBUG, Archive Server and Time Source | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-19 Closed | Archive Server | Loss of User interface due to connector failure | Loss of User interface | Inability to send message | Loss of message signal to User | II | II | DASCON receives status on a periodic basis. |
| 1-20 Closed | Archive Server | Low User interface due to connector failure | Low User signal | Redefines segment | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-21 Closed | Archive Server | Noisy User interface due to connector failure | Noisy User signal | Redefines segment | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-22 Closed | Archive Server | Inadvertent User interface due to connector failure | Inadvertent User signal | Redefines segment | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-23 Closed | Archive Server | Loss of User interface due to hardware failure | Loss of User interface | Inability to send message | Inability to receive DMG message | II | II | DASCON receives status on a periodic basis. |
| 1-24 Closed | Archive Server | Low User interface due to hardware failure | Low User signal | Redefines segment | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-25 Closed | Archive Server | Noisy User interface due to hardware failure | Noisy User signal | Redefines segment | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-26 Closed | Archive Server | Inadvertent User interface due to hardware failure | Inadvertent User signal | Redefines segment | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-27 Open | Archive Server | Loss of User interface due to software error | Loss of User interface | Inability to send message | Inability to receive DMG message | II | II | User requests status on a periodic basis. |
| 1-28 Closed | Archive Server | Inadvertent User interface due to software error | Inadvertent User signal | Redefines segment | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 1-29 Closed | Archive Server | Loss of controller due to hardware failure | Loss of Archive Server | Inability to control segment | Loss of User signal | II | II | Archive Server requests status on a periodic basis. |
| 1-30 Open | Archive Server | Loss of controller due to software failure | Loss of Archive Server | Inability to control segment | Loss of User signal | II | II | Archive Server requests status on a periodic basis. |
| 1-31 Closed | Archive Server | Loss of Time source input due to connector failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp capability | III | III | Provide monitoring of input. Provide alert when lost. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|------------------------|---|---|---------------------------------|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-32 Closed | Archive Server | Loss of Time source input due to hardware failure | Loss of external timing ref. | Loss of timing module | Possible loss of time stamp capability | III | III | Provide monitoring of input. Provide alert when lost. |
| 1-33 Open | Archive Server | Loss of fan due to power connector failure | Fan shuts down | Possible loss of Archive Server | Possible loss of signal | III | III | Archive Server monitors fan operation. |
| 1-34 Open | Archive Server | Loss of fan due to hardware failure | Fan shuts down | Possible loss of Archive Server | Possible loss of signal | III | III | Archive Server monitors fan operation. |
| 1-35 Closed | Archive Server | Loss of input power due to connector failure | Power cannot be supplied to the Archive Server | Loss of Archive Server | Loss of User signal | II | IV | Archive Server requests status on a periodic basis. N+1 power supplies provided |
| 1-36 Closed | Archive Server | Low input power due to connector failure | Damage to components in Archive Server | Loss of Archive Server | Loss of User signal | II | IV | Archive Server requests status on a periodic basis. N+1 power supplies provided |
| 1-37 Closed | Archive Server | Noisy input power due to connector failure | Damage to components in Archive Server | Loss of Archive Server | Loss of User signal | II | NA | Failure not possible. |
| 1-38 Closed | Archive Server | Inadvertent power loss due to connector failure | Possible power not supplied to the Archive Server | Loss of Archive Server | Loss of User signal | II | IV | Archive Server requests status on a periodic basis. N+1 power supplies provided |
| 1-39 Closed | Archive Server | Loss of power due to hardware failure | Power cannot be supplied to the Archive Server | Loss of Archive Server | Loss of User signal | II | IV | Archive Server requests status on a periodic basis. N+1 power supplies provided |
| 1-40 Closed | Archive Server | Low power due to hardware failure | Damage to components in Archive Server | Loss of Archive Server | Loss of User signal | II | IV | Archive Server requests status on a periodic basis. N+1 power supplies provided |
| 1-41 Closed | Archive Server | Noisy power due to hardware failure | Damage to components in Archive Server | Loss of Archive Server | Loss of User signal | II | NA | Failure not possible. |
| 1-42 Closed | Archive Server | Inadvertent power loss due to hardware failure | Possible damage to components in Archive Server | Loss of Archive Server | Loss of User signal | II | IV | Archive Server requests status on a periodic basis. N+1 power supplies provided |

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Note 1: "I" is Initial Severity Class (assigned at PDR); "F" is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|-------------------------|---|------------------------|------------------------------|--|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-1 Closed | Archive Ethernet Switch | Loss Archive Server interface due to connector failure | Loss of DMG signal | Inability to send DMG input | Possible loss of DMG signal | III | III | Archive Server requests status on a periodic basis. |
| 2-2 Closed | Archive Ethernet Switch | Low Archive Server interface due to connector failure | Low DMG signal | Inability to send DMG input | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-3 Closed | Archive Ethernet Switch | Noisy Archive Server interface due to connector failure | Noisy DMG signal | Inability to send DMG input | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-4 Closed | Archive Ethernet Switch | Inadvertent Archive Server interface due to connector failure | Inadvertent DMG signal | Incorrect DMG signal sent | Incorrect DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-5 Closed | Archive Ethernet Switch | Loss Archive Server interface due to hardware failure | Loss of DMG signal | Inability to send DMG input | Possible loss of DMG signal | III | III | Archive Server requests status on a periodic basis. |
| 2-6 Closed | Archive Ethernet Switch | Low Archive Server interface due to hardware failure | Low DMG signal | Inability to send DMG input | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-7 Closed | Archive Ethernet Switch | Noisy Archive Server interface due to hardware failure | Noisy DMG signal | Inability to send DMG input | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-8 Closed | Archive Ethernet Switch | Inadvertent Archive Server interface due to hardware failure | Inadvertent DMG signal | Incorrect DMG signal sent | Incorrect DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-9 Closed | Archive Ethernet Switch | Loss of DMG interface due to connector failure | Loss of DMG signal | Inability receive DMG signal | Possible loss of DMG signal | III | III | Archive Server requests status on a periodic basis. |
| 2-10 Closed | Archive Ethernet Switch | Low DMG interface due to connector failure | Low DMG signal | Inability receive DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-11 Closed | Archive Ethernet Switch | Noisy DMG interface due to connector failure | Noisy DMG signal | Inability receive DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|-------------------------|--|------------------------|------------------------------|--------------------------------------|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-12 Closed | Archive Ethernet Switch | Inadvertent DMG interface due to connector failure | Inadvertent DMG signal | Redefines DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-13 Closed | Archive Ethernet Switch | Loss of DMG interface due to hardware failure | Loss of DMG signal | Inability receive DMG signal | Possible loss of DMG signal | III | III | Archive Server requests status on a periodic basis. |
| 2-14 Closed | Archive Ethernet Switch | Low DMG interface due to hardware failure | Low DMG signal | Inability receive DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-15 Closed | Archive Ethernet Switch | Noisy DMG interface due to hardware failure | Noisy DMG signal | Inability receive DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |
| 2-16 Closed | Archive Ethernet Switch | Inadvertent DMG interface due to hardware failure | Inadvertent DMG signal | Redefines DMG signal | Loss of DMG signal – mission failure | II | NA | Digital signal; failure mode not possible. |

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Note 1: “I” is Initial Severity Class (assigned at PDR); “F” is Final Severity Class (assigned at CDR)

Appendix 3-J:

Demodulator Group (DMG) Configuration Item

FMEA Worksheets

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|---|-----------------------------|-------------------------------------|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-1 Closed | DMU | Loss of inputs due to IF Switch Interconnect failure | Data signals not received by DMG | No effect | Loss of 8 signal processors. | II | II | Loss of inputs are detected and reported |
| 1-2 Closed | DMU | Low inputs due to IF Switch Interconnect failure | Low signals received by DMG | No effect | Loss of 8 signal processors. | II | II | Loss of inputs are detected and reported |
| 1-3 Closed | DMU | Noisy inputs due to IF Switch Interconnect failure | Noisy signals received by DMG | No effect | Loss of 8 signal processors. | II | NA | Invalid Failure Mode |
| 1-4 Closed | DMU | Loss of single input due to IF Switch Interconnect failure | Single data signal not received by DMG | No effect | Loss of signal processor. | II | II | Loss of inputs are detected and reported |
| 1-5 Closed | DMU | Low single input due to IF Switch Interconnect failure | Single low data signal received by DMG | No effect | Loss of signal processor. | II | II | Low signal is detected and reported. |
| 1-6 Closed | DMU | Noisy single input due to IF Switch Interconnect failure | Single noisy data signal received by DMG | No effect | Potential loss of signal processor. | II | II | Invalid Failure Mode |
| 1-7 Closed | DMU | Loss of single input due to connector failure | Single data signal not received by DMG | No effect | Loss of signal processor. | II | II | Loss is detected and reported. |
| 1-8 Closed | DMU | Low single input due to connector failure | Single low data signal received by DMG | No effect | Loss of signal processor. | II | II | Low signal is detected and reported. |
| 1-9 Closed | DMU | Noisy single input due to connector failure | Single noisy data signal received by switch | No effect | Possible loss of signal processor. | II | II | Invalid Failure Mode |
| 1-10 Closed | DMU | Loss of freq. ref. due to connector failure | Loss of external freq. ref. | Degradation of DMG | Loss of signal processors. | III | III | Frequency reference monitored and alert provided if lost. |
| 1-11 Closed | DMU | Low freq. ref. due to connector failure | Low external freq. ref. | Possible degradation of DMG | Loss of signal processors. | III | IV | Frequency reference monitored and alert provided if lost. Redundant signal paths and automatic switchover provided. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|-----------------------------|----------------------------|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 1-12 Closed | DMU | Noisy freq. ref. due to connector failure | Noisy external freq. ref. | Possible degradation of DMG | Loss of signal processors. | III | IV | Frequency reference monitored and alert provided if lost. Redundant signal paths and automatic switchover provided. |
| 1-13 Closed | DMU | Loss of output due to hardware failure | Loss of processed data signal to Control Processor | Loss of DMG signal | Loss of signal processor. | II | III | DMU data/status is reported on redundant buses. |
| 1-14 Closed | DMU | Low output due to hardware failure | Low processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; Output is digital signal. |
| 1-15 Closed | DMU | Noisy output due to hardware failure | Noisy processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; Output is digital signal. |
| 1-16 Closed | DMU | Inadvertent output due to hardware failure | Inadvertent processed data signal to Control Processor | Incorrect DMG signal | Loss of signal processor. | II | II | Signal errors will be detected by PTP formatting problems. |
| 1-17 Closed | DMU | Loss of output due to connector failure | Loss of processed data signal to Control Processor | Loss of DMG signal | Loss of signal processor. | II | II | No data detected by CP based on receiving state. |
| 1-18 Closed | DMU | Low output due to connector failure | Low processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; Output is digital signal. |
| 1-19 Closed | DMU | Noisy output due to connector failure | Noisy processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; Output is digital signal. |
| 1-20 Closed | DMU | Inadvertent output due to connector failure | Inadvertent processed data signal to Control Processor | Incorrect DMG signal | Loss of signal processor. | II | II | Signal errors will be detected by PTP formatting problems. |
| 1-21 Closed | DMU | Loss of control signal due to connector failure | Inability to control DMG – possible inability to process signal | Possible degradation of DMG | Loss of signal processor. | III | III | Detected and reported; monitoring/feedback for control commands is supplied. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|--|---|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 1-22 Closed | DMU | Low control signal due to connector failure | Inability to or inadvertent control of DMG – inability to process signal | Degradation of DMG | Loss of signal processor. | II | NA | Invalid failure mode; digital signal. |
| 1-23 Closed | DMU | Noisy control signal due to connector failure | Inability to or inadvertent control of DMG –inability to process signal | Degradation of DMG | Loss of signal processor. | II | NA | Invalid failure mode; digital signal. |
| 1-24 Closed | DMU | Inadvertent control signal due to connector failure | Inadvertent control of DMG – inability to process signal | Degradation of DMG | Loss of signal processor. | II | II | Control signal formats will flag connection if lost or disrupted. |
| 1-25 Closed | DMU | Loss of status signal due to connector failure | Loss of DMG status | Inability to determine condition of DMG | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Control and status use same connector. Loss of signal detected and reported. |
| 1-26 Closed | DMU | Low status signal due to connector failure | Loss of or inadvertent DMG status | Inability to determine or false condition of DMG | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid failure mode; digital signal. |
| 1-27 Closed | DMU | Noisy status signal due to connector failure | Loss of or inadvertent DMG status | Inability to determine or false condition of DMG | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid failure mode; digital signal. |
| 1-28 Closed | DMU | Inadvertent status signal due to connector failure | Incorrect status of DMG | False condition of DMG | Possible loss of multiple processors | III | IV | Control signal formats will flag connection if lost or disrupted. |
| 1-29 Closed | DMU | Loss of power to card due to connector failure | Complete loss of card. Inability to process incoming signal | Complete loss of DMG Assembly | Loss of message – mission failure | II | IV | Power will be provided on multiple pins for all voltages and grounds. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|-------------------------------|-----------------------------------|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 1-30 Closed | DMU | Low power to card due to connector failure | Loss of card. Inability to process incoming signal | Complete loss of DMG Assembly | Loss of message – mission failure | II | II | Sensed by supplies and reported; also sensed by DMU card during broadcast. |
| 1-31 Closed | DMU | Noisy power to card due to connector failure. | Reset or loss of card. Loss of processing of incoming signal | Complete loss of DMG Assembly | Loss of message – mission failure | II | II | Sensed by supplies and reported; also sensed by DMU card during broadcast. |
| 2-1 Closed | Chassis | Loss of signal from DMG to CP due to connector failures | Loss of processed data signal to Control Processor | Loss of DMG signal | Loss of message. | II | III | CP uses common pins for data, control and status transfers. Routine status/control signals will detect and report signal loss or format problems to DCON within 2 seconds. |
| 2-2 Closed | Chassis | Low signal from DMG to CP due to connector failures | Low processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; digital signal. |
| 2-3 Closed | Chassis | Noisy signal from DMG to CP due to connector failures | Noisy processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; digital signal. |
| 2-4 Closed | Chassis | Inadvertent signal from DMG to CP due to connector failures | Inadvertent processed data signal to Control Processor | Incorrect DMG signal | Incorrect message. | II | II | Signal errors will be detected by PTP formatting problems. |
| 2-5 Closed | Chassis | Loss of signal from DMG to CP due to backplane failures | Loss of processed data signal to Control Processor | Loss of DMG signal | Loss of message. | II | II | CP will detect loss of data. No data detected by CP based on receiving state. |
| 2-6 Closed | Chassis | Low signal from DMG to CP due to backplane failures | Low processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; digital signal. |
| 2-7 Closed | Chassis | Noisy signal from DMG to CP due to backplane failures | Noisy processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; digital signal. |
| 2-8 Closed | Chassis | Inadvertent signal from DMG to CP due to backplane failures | Inadvertent processed data signal to Control Processor | Incorrect DMG signal | Loss of signal processor. | II | II | Signal errors will be detected by PTP formatting problems. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|---------------------------|--|---|-----------------------------|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 2-9 <i>Closed</i> | Chassis | Loss of all data signals due to catastrophic backplane failure | Loss of processed data signal to Control Processor | Loss of DMG signal | Loss of signal processor. | II | II | Sensed and reported; redundant signal paths and automatic switchover mitigate problems. |
| 2-10 <i>Closed</i> | Chassis | Loss of control signal due to connector failure | Inability to control DMG – possible inability to process signal | Possible degradation of DMG | Possible loss of multiple signal processors | III | III | CP uses common pins for data, control and status transfers. Routine status/control signals will detect and report signal loss or format problems to DCON within 2 seconds. All control signals use fixed formats. |
| 2-11 <i>Closed</i> | Chassis | Low control signal due to connector failure | Inability to or inadvertent control of DMG – possible inability to process signal | Degradation of DMG | Loss of signal processors. | II | NA | Invalid failure mode; digital signal. |
| 2-12 <i>Closed</i> | Chassis | Noisy control signal due to connector failure | Inability to or inadvertent control of DMG – possible inability to process signal | Degradation of DMG | Loss of signal processors. | II | NA | Invalid failure mode; digital signal. |
| 2-13 <i>Closed</i> | Chassis | Inadvertent control signal due to connector failure | Inadvertent control of DMG – possible inability to process signal | Degradation of DMG | Loss of signal processors. | II | III | Command structure prevents this. CP/DMG will sense and report invalid commands. |
| 2-14 <i>Closed</i> | Chassis | Loss of control signal due to backplane failure | Inability to control DMG – possible inability to process signal | Possible degradation of DMG | Loss of signal processors. | III | III | Control signal errors will be sensed and reported. |
| 2-15 <i>Closed</i> | Chassis | Low control signal due to backplane failure | Inability to or inadvertent control of DMG – possible inability to process signal | Degradation of DMG | Loss of signal processors. | II | NA | Invalid failure mode; digital signal. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|---------------------------|---|---|--|---|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 2-16 <i>Closed</i> | Chassis | Noisy control signal due to backplane failure | Inability to or inadvertent control of DMG – possible inability to process signal | Degradation of DMG | Loss of signal processors. | II | NA | Invalid failure mode; digital signal. |
| 2-17 <i>Closed</i> | Chassis | Inadvertent control signal due to backplane failure | Inadvertent control of DMG – possible inability to process signal | Degradation of DMG | Loss of signal processors. | II | IV | Command structure prevents this. CP/DMG will sense and report invalid commands. |
| 2-18 <i>Closed</i> | Chassis | Loss of status signal due to connector failure | Loss of DMG status | Inability to determine condition of DMG | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Fault will be detected and reported; loss of status signal. |
| 2-19 <i>Closed</i> | Chassis | Low status signal due to connector failure | Loss of or inadvertent DMG status | Inability to determine or false condition of DMG | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid failure mode; digital signal. |
| 2-20 <i>Closed</i> | Chassis | Noisy status signal due to connector failure | Loss of or inadvertent DMG status | Inability to determine or false condition of DMG | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid failure mode; digital signal. |
| 2-21 <i>Closed</i> | Chassis | Inadvertent status signal due to connector failure | Incorrect status of DMG | False condition of DMG | Possible loss of multiple processors | III | IV | Loss of or inadvertent status is sensed and reported. CP uses common pins for data, control and status transfers. Routine status/control signals will detect and report signal loss or format problems to DCON within 2 seconds. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|---------------------------|--|-------------------------------------|--|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 2-22 <i>Closed</i> | Chassis | Loss of status signal due to backplane failure | Loss of DMG status | Inability to determine condition of DMG | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Loss of or inadvertent status is sensed and reported. CP uses common pins for data, control and status transfers. Routine status/control signals will detect and report signal loss or format problems to DCON within 2 seconds. |
| 2-23 <i>Closed</i> | Chassis | Low status signal due to backplane failure | Loss of or inadvertent DMG status | Inability to determine or false condition of DMG | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid failure mode; digital signal. |
| 2-24 <i>Closed</i> | Chassis | Noisy status signal due to backplane failure | Loss of or inadvertent DMG status | Inability to determine or false condition of DMG | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid failure mode; digital signal. |
| 2-25 <i>Closed</i> | Chassis | Inadvertent status signal due to backplane failure | Incorrect status of DMG | False condition of DMG | Possible loss of multiple processors | III | IV | Loss of or inadvertent status is sensed and reported. CP uses common pins for data, control and status transfers. Routine status/control signals will detect and report signal loss or format problems to DCON within 2 seconds. |
| 2-26 <i>Closed</i> | Chassis | Loss of power due to backplane failure | Loss of power to one or more cards. | Inability to operate DMG | Loss of 8 signal processors. | II | III | Power is monitored and alert provided if lost. Redundant signal paths and automatic switchover provided. |
| 2-27 <i>Closed</i> | Chassis | Low power due to backplane failure | Loss of power to one or more cards. | Inability to operate DMG | Loss of 8 signal processors. | II | III | Sensed and reported by power supplies and DMUs. |
| 2-28 <i>Closed</i> | Chassis | Noisy power due to backplane failure | Reset or loss of one or more cards. | Inability to operate DMG | Loss of 8 signal processors. | II | III | High level noise will be detected and reported. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|---------------|---------------------------|---|---|-----------------------------------|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 3-1 Closed | Control Card | Loss of message signal due to connector failure | Loss of processed data signal to Control Processor | Loss of DMG signal | Loss of message. | II | III | No data detected by CP based on receiving state. |
| 3-2 Closed | Control Card | Low message signal due to connector failure | Low processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; digital signal. |
| 3-3 Closed | Control Card | Noisy message signal due to connector failure | Noisy processed data signal to Control Processor | Degradation of DMG signal | Possible loss of message | III | NA | Invalid failure mode; digital signal. |
| 3-4 Closed | Control Card | Inadvertent message signal due to connector failure | Inadvertent processed data signal to Control Processor | Incorrect DMG signal | Incorrect message. | II | III | Signal errors will be detected by PTP formatting problems. |
| 3-5 Closed | Control Card | Loss of control signal due to connector failure | Inability to control DMG – possible inability to process signal | Possible degradation of DMG | Possible loss of multiple processors | III | III | Detected and reported; monitoring/feedback for control commands is supplied. Provide monitoring of input. Provide alert when lost. Sensed and reported; redundant signal paths and automatic switchover mitigate problem. |
| 3-6 Closed | Control Card | Low control signal due to connector failure | Inability to or inadvertent control of DMG – possible inability to process signal | Possible degradation of DMG | Loss of multiple processors – mission failure | II | NA | Invalid failure mode; digital signal. |
| 3-7 Closed | Control Card | Noisy control signal due to connector failure | Inability to or inadvertent control of DMG – possible inability to process signal | Possible degradation of DMG | Loss of multiple processors – mission failure | II | NA | Invalid failure mode; digital signal. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|--|--|--|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 3-8 Closed | Control Card | Inadvertent control signal due to connector failure | Inadvertent control of DMG – possible inability to process signal | Possible degradation of DMG | Loss of multiple processors – mission failure | II | III | Control signal formats will flag connection if lost or disrupted. Provide monitoring of input. Provide alert when lost. Sensed and reported; redundant signal paths and automatic switchover mitigate problem. |
| 3-9 Closed | Control Card | Loss of status signal due to connector failure | Loss of DMG status | Inability to determine condition of DMG | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Control and status use same connector. Loss of signal detected and reported. |
| 3-10 Closed | Control Card | Low status signal due to connector failure | Loss of or inadvertent DMG status | Inability to determine or false condition of DMG | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid failure mode; digital signal. |
| 3-11 Closed | Control Card | Noisy status signal due to connector failure | Loss of or inadvertent DMG status | Inability to determine or false condition of IBU | Inability to diagnose failures/ troubleshoot or false alert – No mission effect | IV | NA | Invalid failure mode; digital signal. |
| 3-12 Closed | Control Card | Inadvertent status signal due to connector failure | Incorrect status of DMG | False condition of DMG | Possible loss of multiple processors | III | III | Control signal formats will flag connection if lost or disrupted. |
| 3-13 Closed | Control Card | Loss of message signal due to software error | Loss of processed data signal to Control Processor | Loss of DMG signal | Loss of signal processor. | II | II | CP will detect and report not valid. |
| 3-14 Closed | Control Card | Inadvertent message signal due to software error | Inadvertent processed data signal to Control Processor | Incorrect DMG signal | Loss of signal processor. | II | II | PTP will sense and report invalid message formats. Temporary loss of signal processor. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|--|---|---|---|----------------------|-----|---|
| | | | Local | NHA | End | I | F | |
| 3-15 Closed | Control Card | Loss of control signal due to software error | Inability to redefine DMG operation – possible inability to process signal | Possible loss of multiple signal processor paths – possible degradation of DMG | Possible loss of multiple signal processors | III | III | Provide monitoring of input. Provide alert when lost. Sensed and reported; redundant signal paths and automatic switchover mitigate problem. Any type of bus loss will be detected and reported. |
| 3-16 Closed | Control Card | Inadvertent control signal due to software error | Redefines DMG operation – possible inability to process signal | Loss of multiple signal processor paths – possible degradation of DMG | Loss of multiple signal processors – mission failure | II | III | Formatting of bus control/status signals prevents erroneous signals from being implemented without being reported and detected. |
| 3-17 Closed | Control Card | Loss of status signal due to software error | Loss of DMG status | Inability to determine condition of DMG | Inability to diagnose failures/ troubleshoot – No mission effect | IV | IV | Provide monitoring of input. Provide alert when lost. Sensed and reported; redundant signal paths and automatic switchover mitigate problem. Any type of bus loss will be detected and reported. |
| 3-18 Closed | Control Card | Inadvertent status signal due to software error | Incorrect status of DMG | False condition of DMG | Possible loss of multiple processors | III | III | Formatting of bus control/status signals prevents erroneous signals from being implemented without being reported and detected. |
| 3-19 Closed | Control Card | Loss of Archive interface due to connector failure | Loss of Archive Interface | Inability to send message | Loss of DMG and signal processing segment. | II | III | Loss is sensed and reported immediately. Provide monitoring of input. Provide alert when lost. Sensed and reported; redundant signal paths and automatic switchover mitigate problem. |
| 3-20 Closed | Control Card | Low Archive interface due to connector failure | Low Archive interface signal | Degradation of message signal | Possible loss of message | III | NA | TCP/IP protocol prevents failure mode |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|-----------------------|---------------------------|--|---|--|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 3-21 <i>Closed</i> | Control Card | Noisy Archive interface due to connector failure | Noisy Archive interface signal | Degradation of message signal | Possible loss of message | III | NA | TCP/IP protocol prevents failure mode |
| 3-22 <i>Closed</i> | Control Card | Inadvertent Archive interface due to connector failure | Incorrect message signal to Archive | Incorrect DMG signal | Incorrect message. | II | NA | TCP/IP protocol prevents failure mode |
| 3-23 <i>Closed</i> | Control Card | Loss of Archive interface due to software error | Loss of Archive Interface | Inability to send message | Loss of message – DMG loss. | II | II | Loss is sensed by DSER and reported. |
| 3-24 <i>Closed</i> | Control Card | Inadvertent Archive interface due to software error | Incorrect message signal to Archive | Incorrect DMG signal | Incorrect message – mission failure | II | NA | TCP/IP will sense and ignore inadvertent sends. |
| 3-25 <i>Closed</i> | Control Card | Loss of controller due to hardware failure | Inability to control DMG | Possible loss of DMG | Possible loss of 8 signal processors | III | III | Loss is sensed by DSER and reported. |
| 3-26 <i>Closed</i> | Control Card | Loss of DCON interface due to connector failure | Loss of DCON interface | Inability to control/ status DMG | Possible loss of 8 signal processors | III | III | Loss is sensed and reported within 2 seconds. Provide monitoring of input. Provide alert when lost. Sensed and reported; redundant signal paths and automatic switchover mitigate problem |
| 3-27 <i>Closed</i> | Control Card | Low DCON interface signal due to connector failure | Low DCON control signal | Inability to control or redefines DMG | Loss of 8 signal processors | II | NA | TCP/IP does not accept packets that fail forward error correction. |
| 3-28 <i>Closed</i> | Control Card | Noisy DCON interface due to connector failure | Noisy DCON control signal | Inability to control or redefines DMG | Loss of DMG Control | II | NA | TCP/IP does not accept packets that fail forward error correction. |
| 3-29 <i>Closed</i> | Control Card | Inadvertent DCON interface due to connector failure | Inadvertent DMG control signal received | Redefines DMG | Loss of 8 signal processors | II | NA | TCP/IP does not accept packets that fail forward error correction. |
| 3-30 <i>Closed</i> | Control Card | Loss of DCON interface due to software error | Loss of DCON Interface | Inability to control DMG | Possible loss of multiple signal processors | III | III | DCON will sense and report TCP/IP failure within 2 seconds. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------|---------------------------|---|---|-------------------------|---|----------------------|-----|--|
| | | | Local | NHA | End | I | F | |
| 3-31 Closed | Control Card | Inadvertent Archive interface due to software error | Incorrect message signal to Archive | Incorrect DMG signal | Loss of multiple signal processors – mission failure | II | NA | TCP/IP will sense and ignore inadvertent sends. |
| 4-1 Closed | Fan Assembly | Loss of power due to connector failure | Fan shuts down | Possible loss of DMG | Possible loss of 8 signal processors | III | III | Temperature sensor monitors fan operation. |
| 4-2 Closed | Fan Assembly | Low power due to connector failure | Motor burns up - fan shuts down | Possible loss of DMG | Possible loss of 8 signal processors | III | NA | Noise and low voltage on AC will not affect fans. |
| 4-3 Closed | Fan Assembly | Noisy power due to connector failure | Possible motor problems resulting in the fan shutting down | Possible loss of DMG | Possible loss of 8 signal processors | III | NA | Noise and low voltage on AC will not affect fans. |
| 4-4 Closed | Fan Assembly | Hardware failure | Fan shuts down | Possible loss of DMG | Possible loss of 8 signal processors | III | III | Redundant/hot-swappable fans are mounted in a single tray. Loss of a single fan will create a temperature rise which is sensed and reported by CI. |
| 5-1 Closed | Power supply | Loss of supply power to DMG | Power cannot be supplied to the DMG | Loss of DMG | Loss of 8 signal processors. | II | III | No change necessary. DCON will detect loss of power and provide alert. |
| 5-2 Closed | Power supply | Low supply power to DMG | Power supplies shut down and power cannot be supplied to the DMG | Loss of DMG | Loss of 8 signal processors. | II | NA | Supply power is AC and relatively immune to low voltage or noise problems. Facility power is closely regulated and monitored. |
| 5-3 Closed | Power supply | Noisy supply power to DMG | Power supplies shut down and power cannot be supplied to the DMG | Loss of DMG | Loss of 8 signal processors. | II | NA | Supply power is AC and relatively immune to low voltage or noise. Facility power is closely regulated and monitored. |
| 5-4 Closed | Power supply | Loss of DC power due to connector failure | Power cannot be supplied to the DMG | Loss of DMG | Loss of 8 signal processors. | II | IV | Redundant, N+1 power supplies are hot-swappable. Loss or low power is sensed and reported. |
| 5-5 Closed | Power supply | Low DC power due to connector failure | Damage to components on circuit cards – loss of cards | Loss of DMG | Loss of 8 signal processors. | II | IV | Redundant, N+1 power supplies are hot-swappable. Loss or low power is sensed and reported. |

| ID/ Status | Item/ Functional ID | Failure Modes and Causes | Failure Effect | | | Severity (Note 1) | | Mitigation/Resolution |
|----------------------|---------------------------|--|--|-------------|---------------------------------|----------------------|----|--|
| | | | Local | NHA | End | I | F | |
| 5-6 <i>Closed</i> | Power supply | Noisy DC power due to connector failure | Damage to components on circuit cards – loss of cards | Loss of DMG | Loss of 8 signal processors. | II | IV | Filtering provided, as well as voltage sensing for large DC noise levels. |
| 5-7 <i>Closed</i> | Power supply | Loss of DC power due to hardware failure | Power cannot be supplied to the DMG | Loss of DMG | Loss of 8 signal processors. | II | IV | Redundant, N+1 power supplies are hot-swappable. Loss or low power is sensed and reported. |
| 5-8 <i>Closed</i> | Power supply | Low DC power due to hardware failure | Damage to components on circuit cards – loss of cards | Loss of DMG | Loss of 8 signal processors. | II | IV | Redundant, N+1 power supplies are hot-swappable. Loss or low power is sensed and reported. |
| 5-9 <i>Closed</i> | Power supply | Noisy DC power due to hardware failure | Damage to components on circuit cards – loss of cards | Loss of DMG | Loss of 8 signal processors. | II | IV | Filtering provided, as well as voltage sensing for large DC noise levels. |